A DIALOGIC ACTION PERSPECTIVE

ON OPEN COLLECTIVE INQUIRY IN ONLINE FORUMS

by

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Preface

In this dissertation, I have tried to share my experience of inquiry on how participants of open collective inquiry shape their dialogic interactions to generate working knowledge in online forums. This study was motivated by recognizing that abundant knowledge available in online forums do not always guarantee successful inquiry outcomes and that people in online forums are not altruistic enough to help others "unconditionally"; Here, "unconditionally" does not mean "no reward" but refers to absence of prerequisite fulfillment. In other words, members of online forums act to help when they were convinced to do so, and as such, not all members have equal opportunities for successful inquiry; it depends! Then, the question is how to make it happen more likely and better.

This inquiry had originally begun while I attempted to make sense my experience of collaborative classroom learning. Students' self-initiative and active participation are crucial values of good collaborative learning, but the values were sometimes exploited by a sort of "speak out, whatever you talk" tactics; Some students spoke out for the sake of time-occupancy that is mythically considered as an evidence of classroom participation in the Western culture. Such contribution, unfortunately, was obviously motivated for self-satisfaction and extrinsic class participation credit rather than for collaboration with others, and did not add much to collaborative class learning because those left lesser room to negotiate with others and to transform their knowledge and belief. To the contrary, much of constructive contribution was mostly come from those who maintained their awareness towards how classroom learning moved, which was not

necessarily actualized through quantitative occupation; They pinpointed key issues in negotiating for knowledge transformation and construction and responded to others reflexively in giving feedback, thought and idea.

This observation naturally led me to challenge the prevalent belief toward the significance of quantitative knowledge contribution and potential contributors in collaborative learning. Advanced information and communication technologies thus are recognized for their capabilities for enhancing human being's learning capability by bringing more knowledge on one's hands. Although acknowledging the importance of quantitative knowledge contribution that enlarges publicly accessible knowledge pools, what makes the pools alive is people's interactive participation in continued validation of knowledge and adaptive application of the knowledge. The idea behind the current Web 2.0, e.g., Wikipedia, blogs, and online forums, represents such contrast. Different from earlier web technologies that emphasized primarily information retrieval and distribution, the new technologies accommodate and facilitate participatory information sharing and collaborative reasoning, namely open collective inquiry. Here, knowledge is not transferred like object-like entity from contributors to seekers but is collectively generated through lateral interactions among participants to satisfy individual desires. Contents generated in such technological platforms are open for ongoing review, validation, and modification–sharing of inquiry process rather than sharing of object-like knowledge.

Provided that, a true attribute of successful collaborative learning is facilitating

participants' awareness to inquiry processes and guiding their negotiation for knowledge transformation and generation. Information and communication technologies such as online forums provide affordances for open collective inquiry. I carried out my inquiry by believing Boland and colleagues' notion of "hermeneutic process" (1994) and the concept of "community of knowing" (1995) as valid claims. Learning is accomplished through ongoing negotiation and transformation of meaning among participants with different perspectives. In particular, I presume that dialogue embodies open collective inquiry processes and focused on studying what actors do to achieve felicitous open collective inquiry outcomes through dialogic inquiry. I attempted to write this dissertation as if I narrated my journey of inquiry to the research topic in which I confronted with challenges, strived to overcome them, and learned lessons from mistakes and failures. I described those experiences and my sense-making processes to initiate open collective inquiry dialogue as to how we learn better and how information technologies are designed to support the process.

A Dialogic Action Perspective on Open Collective Inquiry in Online Forums

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Abstract

In today's networked environment, online forums emerge as a popular form of social structures that have greater opportunities for learning in various organizational contexts. A plethora of studies have investigated the phenomenon to identify factors of its success, such as individual characteristics and organizational structure. However, how such factors shape collaborative learning processes and influence outcomes has been largely understudied. Furthermore, the learning process in online forums has been simply presumed as a kind of general organizational learning, despite its unique situation of learning from strangers. This dissertation study focuses on online forums' highly motivated for problem-based learning and explores a dynamic process of such learning, namely *open collective inquiry (OCI).* Presuming that dialogue embodies open collective inquiry processes, this study investigated characteristics of OCI dialogues that influence distinct types of inquiry outcomes using a grounded theory method. In particular, the current study highlights *what participants do* for OCI and *how they do it* through their dialogue. Based on distinct purposes for dialogic actions, six action domains were identified that constitute OCI processes: action domains to initiate inquiry, to maintain commitment, to guide inquiry process, to frame a problem, to negotiate solutions, and to confirm workability. These action domains were interrelated to shape

OCI processes. Varying extent to which participants performed purposes of these action domains was found to influence distinct types of outcomes, such as full closure, partial closure, non-closure, and degraded closure. To derive a more systemic account of how participants of OCI perform such purposes, three dimensions of dialogic action were proposed: action performed, content of action, and argumentative components. These dimensions were used for characterizing essential dialogic actions in each action domain for successful OCI. In this way, three factors are proposed that influence OCI outcomes: fulfillment of essential dialogic actions, OCI initiators' role, and inquiry context. Based on these findings, a dialogic action model of OCI in online forums. The model emphasizes OCI initiators' active roles and inquiry context encouraging validation and improvement. These characteristics influence essential dialogic actions of open collective inquiry that perform reflection, experimentation, and validation. Discussing implications for research and practice concludes this dissertation study.

Chapter 1. Introduction

In today's networked environment, online forums have become the most prevalent ICT-enabled social structure that provide affordances for collaborative learning (DeSanctis et al. 2003). Wasko and Faraj (2005) call the self-organizing and emergent social structures that are dedicated to problems of practice *electronic networks of practice.* Online forums enable participants distributed in time and space to congregate and combine their different perspectives, expertise, and experience to address emergent knowledge needs shared in networks of practice. Online forums have been widely adapted to various organizational contexts where collaborative learning forms an instrumental practice; particularly where there arises greater demand for reaching out external knowledge resources, i.e., open innovation, user collaboration, and customer engagement (Boudreau and Lakhani 2009; Chesbrough et al. 2006; Fredberg et al. 2008; Sawhney et al. 2005; West and Gallagher 2006).

As such, how to facilitate collaborative learning in online forums has been a crucial subject matter for both IS research and practice. A body of research, which considers knowledge contribution to precondition collaborative learning, emphasizes motivation systems; altruistic individual knowers who display goodwill to help others and the culture of a gift economy that rewards helping behaviors with social capital are considered as the two primary factors that sustain networks of practice (Bergquist and Ljungberg 2001; Constant et al. 1996; Wasko and Faraj 2005). Another that highlights the transformative nature of knowledge argues that participants are more motivated for learning opportunities, and thus, that organizational structure that facilitates such

learning opportunities and participants' interactions are crucial (Kogut 2000; Lakhani and Von Hippel 2003; Von Krogh et al. 2003).

However, how such factors affect collaborative learning in online forums is plainly generalized a kind of organizational learning, overlooking a critical difference between conventional organizational learning from colleagues and online collaborative learning from strangers. In online forums, organizational resources (e.g., members' expertise and participant) and structures (e.g., culture and identity) are unpredictable and barely controllable. Therefore, I presume that online collaborative learning can be better studied through processes by which participants interact with one another to address their needs. It reminds us of the important point that learning is essentially a demand-side issue that is independent of the abundance of knowledge in a network, and learners' initiatives and participation are of most significance (Brown and Duguid 2002; Dewey 1938). To distinguish such learner-initiated, problem-oriented learning that is open to others' voluntary participation from collaborative learning in general, I will use a term *Open collective inquiry (OCI)* hereafter.

Lacking pre-established formal work structures and face-to-face interaction that delivers tacit knowledge and contextual information, people depend on "dense dialogue" to overcome the constraints and to participate in ICT-mediated collaboration (DeSanctis et al. 2003; Fayard and DeSanctis 2008). A recent study by Kudaravalli and Faraj (2008) shows that structures of collaboration, which initiate and sustain dialogue, are more influential on the effectiveness of collaboration than structural and social variables such

as community resource and participants' diversity. Therefore, dialogue, as a sole means of interaction in online forums, is closely associated with successful knowledge work in open collective inquiry, and good dialogue practice enables successful open collective inquiry outcomes. However, the descriptive explanation of what is good dialogue practice and how it facilitates successful open collective inquiry is understudied in the current IS literature.

In this study, I aim to understand online open collective inquiry process. Presuming that dialogue embodies open collective inquiry, I pursue that objective by investigating participants' dialogic interactions to generate working solutions for problems inquired about. In addition, I aim to investigate characteristics of such dialogic interactions that influence outcomes of open collective inquiry. I derive two research questions like followings:

> **Research Question 1**: What is a dynamic process of open collective inquiry (OCI) in online forums?
>
> **Research Question 2**: What characteristics of dialogic actions influence outcome of open collective inquiry (OCI) in online forums?

This dissertation is organized like followings. In Chapter 2, I review the existing literature of collaborative learning in online communities. I identify two predominant perspectives in the literature — an individual knowledge contribution perspective and an

organizational structure perspective — and present the current growing interest in participants' interactions and communication as a crucial means of online open collective inquiry. In Chapter 3, I illustrate research design and method. I discuss three establish research methods to analyze dialogic interactions — discourse analysis, conversation analysis, and argumentation analysis — as to their relevance to online open collective inquiry. Then, I described research methodology using grounded theory. In Chapter 4, I present findings that address RQ1. I identify six action domains that constitute online open collective inquiry process and their interrelationships: action domains to initiate inquiry, to maintain commitment, to guide inquiry flow, to frame a problem, to negotiate solutions, and to confirm workability. I present three dimensions of dialogic action — action performed, content of action, and argumentative component — to characterize these action domains systemically. In Chapter 5, I present findings for RQ2. I identified three characteristics of OCI dialogic action that influence outcomes: fulfillment of essential dialogic action, OCI initiator's role, and inquiry context. In Chapter 6, I propose a theoretical model of online open collective inquiry and discuss its implications for research and practice.

Chapter 2. Literature Review

Online forums technically are web applications such as listserv or electronic bulletin boards through which people distributed in time and space congregate to exchange messages. They have been recognized to be an effective means of group communication that enable access to knowledge resources with ease, to exchange opinions and thoughts, and to even coordinate civil actions (Butler 2001; Palen et al. 2007; Wasko and Faraj 2005). In the networked environment individuals altruistically expend time and efforts to address others' needs in the lack of strong social ties or explicit reward system (Bergquist and Ljungberg 2001; Von Hippel and Von Krogh 2003; Wasko and Faraj 2005). This endows online forums with great affordances for various types of inquiries (DeSanctis et al. 2003; Fayard and DeSanctis 2008). Focusing on enablers of knowledge contribution, the prior literature tends to highlight individual knowledge contributors' motivations for contributions ─ an individual knowledge contribution perspective ─ and organizational and social characteristics sustaining online communities ─ an organizational structure perspective. I contend these existing approaches for underestimating the importance of learner-initiatives, participants' lateral interactions and their capability to collectively generate working knowledge that is not given or cannot be given at the outset. I propose that such dynamics of open collective inquiry can be better captured through participants' dialogue.

2.1. An Individual Knowledge Contribution Perspective

Research on online forums' knowledge contribution practice got initially inspired with observing the counterintuitive knowledge contribution practice of successful open

source communities. From the conventional organizational viewpoint, knowledge is an object-like entity that is 'out there' to be created, collected, stored, retrieved, and reuse. It can be owned and transferred like private goods. Contributing knowledge to others in an online forum is considered to yield the proprietary right associated with the knowledge, which generates negative apprehension of losing intellectual capital, knowledge power, and competency in organizations (Huber 2001; Thorn and Connolly 1987). Knowledge contribution costs time and cognitive efforts to codify and to generate document (Baba and Nobeoka 1998; Grant 1996b). The costs increase, when there is a significant knowledge and semantic gap between contributors and seekers, and even greater, when contributors are anxious about potential misuse of transferred knowledge (Markus 2001). Studies found that intrinsic motivations, such as knowledge self-efficacy, social capital (reciprocal relationships), enjoyment in helping others, professional reputation, and self-esteem, were an effective means of knowledge contribution when accompanied with organizational climates, communication competence, and recipients' absorptive capacities and participations (Bock et al. 2005; Kankanhalli et al. 2005; Ko et al. 2005; Wasko and Faraj 2005). However, knowledge contribution has been considered as a key challenge despite of its instrumentality in organizational knowledge management (Alavi and Leidner 2001; Szulanski 2000).

To the contrary open source communities offer privileged knowledge (i.e., software and technical advice) free and even allow modification. Developers are willing to expend their resources to help strangers without tangible rewards (Awazu and Desouza 2004; Brown and Booch 2002; O'Reilly 1999). O'Reilly (1999) pointed out that free

contribution of knowledge demonstrated by the example of open source software is not a matter of free license but a matter of "hacker" culture. Giving software free and leaving it open for further modification is a superior method to respond to users' evolving needs and problems in fields and to attract like-minded developers into collaborative networks. Bergquist and Ljungberg (2001) explained such knowledge "giveaway" from the perspective of gift economy. Free contribution creates a culture of openness that in turn invites those who have problems, solutions, and new ideas into the community. Developers can reduce the inefficient barrier between themselves and users and accelerate innovation through fast release-and-fix (Kogut and Metiu 2001). Von Krogh et al. (2003) found that contributing behaviors at various levels of expertise are a key constituent of open source communities. Developers and users maintain cooperative relations and reciprocity that sustain the gift economy. Knowledge in this context is considered to be 'public goods' constructed through open cooperation.

However, such collaborative relationships and reciprocity do not exist naturally in electronic networks of practice. The number of knowledge contributors is much smaller than that of knowledge seekers, and thus, the knowledge contributors are exceedingly overloaded by others' knowledge seeking inquires. Awazu and Desouza (2004) show that only about 20 percent of a community's population contributes 80 percent of the total contributed knowledge. Lakhani and Von Hippel (2002) found that during open source development 50 percent of questions were asked by 24 percent of information seekers, while 2 percent of answer providers addressed 50 percent of questions. Other studies report a similar imbalance between knowledge contribution and seeking (Gohosh

et al. 2002; Lakhani and Von Hippel 2003; Mockus et al. 2002; Raymond 1999). At the same time, a majority of knowledge seekers do not make significant contributions such as constructive feedback and suggestions due to a significant knowledge gap and remain as free riders and passive re-users who only take knowledge without making any contribution. This intense imbalance between knowledge contribution and seeking makes contributors retreat from sharing knowledge (Mockus et al. 2002). This also hampers cooperative relations and the reciprocity that are instrumental to sustain the gift economy and altruistic community culture of open source communities (Baldwin 2006; Bessen 2005; Von Hippel and Von Krogh 2003). Despite such imbalanced reciprocity, open source communities' knowledge sharing practices have been considered successful and have become prevalent in the current networked environment.

Researchers explain that such free giveaway of knowledge under the condition of indirect and unclear reciprocity is possible because of altruistic individual contributors and others' trusts in them as a knowledge resource. Markus et al. (2000) stated that contributors in networks of practice consider social values such as altruism, reputation, and ideology more important than economic benefits and are self-motivated by what they achieve in software development. Wasko and Faraj (2005) found that contributors share a strong community identity and have goodwill to provide their knowledge resource to solve problems of common interest and to help strangers. They were strongly motivated by intrinsic motivations such as expectation of professional reputation, prior experience of sharing, and centrality in network structure. Stewart and Gosain (2006) showed that the ideology of social benefit reinforces cognitive and affective trust toward

the network of practice, which motivates contributors and task effectiveness. The altruistic ideology motivates knowledge contribution and participation, which buttresses resource availability. The increased resource availability reinforces people's reliance on the network of practice as critical knowledge resources and enables its success and sustainability.

Acknowledging the importance of knowledge contribution and of an altruistic culture, I realize that such an individual knowledge-contribution focused view is limited in addressing following three commonly observed phenomena in online communities. First, a large portion of knowledge seeking inquiries remains unattended or inadequately responded, whereas a relatively small portion of inquiries is populated with multiple threads. This implies that the presence of potential knowledge contributors alone cannot reliably constitute knowledge contribution and that knowledge contribution and participation take place selectively. Second, online communication is prone to evoke flaming, such as the use of emotionally charged, strong, antagonistic, and depreciating language, due to the lacking social information and the ephemeral nature of the relationships (Alonzo and Aiken 2004; Hiltz et al. 1989; Sproull and Keisler 1991). Although online communities are characterized by individual goodwill to help others and an altruistic organizational culture, it is undeniable that unconstructive and even deprecating contributions based on self-satisfied offensive motivations commonly occur even in highly knowledge-motivated, technical discourses (Singh and Jayanti 2008, Jung and Boland 2009). Third, much of online forums' dialogue is comprised of questions specifying what was asked and suggested (Kudaravalli and Faraj 2008). This indicates

that adequate understandings of an inquired problem and contributed knowledge is challenging, especially when all communications are textually mediated and asynchronously interpreted. In this context, a close and lateral interaction between knowledge seeking and contribution is instrumental, because both questions and answers are equally critical contributions for the sustainability of online forums (Gu and Jarvenpaa 2003). These issues cannot be adequately addressed by the knowledge contribution focused approach, but need an in-depth investigation on the transformative nature of knowledge and dynamics of knowledge generating interactions.

2.2. An Organizational Structure Perspective

An alternative to the aforementioned knowledge-contribution focused view is the organizational learning perspective that highlights the transformative and contextual nature of knowledge. This approach argues that knowledge is locally embedded in organizational practice and social relationships. Knowledge is socially constructed through an ongoing generative knowledge creation process and collectively maintained in such organizational relationships (Boland and Tenkasi 1995; Brown and Duguid 1991; Brown and Duguid 2000; Hutchins 1995; Latour 1987; Lave 1993; Lave and Wenger 1991a; Nidumolu et al. 2001; Nonaka and Konno 1998; Orr 1990; Weick and Roberts 1993; Wenger 1998). In this way, this approach promotes collaborative organizational learning and knowledge sharing practices by constructing "communities of practice", which nurture and preserve shared organizational knowledge. A community of practice refers to a group of people who are committed to sharing their expertise, knowledge, and experiences, and collaborate to solve problems in creative ways by either face-to-face encounters or distributed and mediated communications (Brown and Duguid 1991;

Goodman and Darr 1998; Kereki et al. 2004; Orlikowski 2002; Wenger and Snyder 2000). Communities of practice are self-perpetuating through reciprocity of expertise rather than affective interpersonal relationships. Such collaboration strengthens interpersonal relationships and reciprocity within the communities. In communities of practices, the knowledge creation is accomplished by establishing a collaborative working environment where members attain the experience of working in communal and coherent manners rather than by acquiring knowledge from other members (Gongla and Rizzuto 2001; Orlikowski 2002). Knowledge sharing in a community of practice is a process of identity construction in order to establish relational attachments (Lave and Wenger 1991b). Strong ties, co-location, demographic similarity, status similarity, and history of prior relationships are the factors that characterize communities of practice (Alavi and Leidner 2001; Hansen 1999). Shared knowledge not only mediates interpersonal relationships such as trust and knowledge resources but also increases group performance (Bouty 2000; Cramton 2001; Nelson and Cooperider 1996; Stasser et al. 2000).

However, electronic networks of communities demonstrate similar practices of knowledge sharing and creation without close interpersonal relationships or prior shared knowledge practices that were considered to be the essential organizational structure in communities of practice. Online forums are built upon weakly bounded social networks, and knowledge resources, such as personal information of 'who knows what', are mostly unclear to members. Although weak ties were known to be inefficient for exchanging complex expertise (Hansen 1999), electronic networks based on weak ties had an

advantage in addressing problem-solving inquiries because people tended to provide objective opinions and solutions. Such weakly bounded electronic communication structures offer opportunities for convenient knowledge seeking and exchange without expending costs on maintaining interpersonal social networks (Constant et al. 1996; Garton et al. 1997; Grandori and Soda 1995; Zhang et al. 2007). In this way, it is convenient for members of online forums to get involved in knowledge-focused discourses in online forums by inviting individuals with similar knowledge motivations and diverse expertise.

Participating in such knowledge-focused discourses offers learning opportunities for knowledge contributors, which are more practical motivations for them to contribute than altruism itself (Lakhani and Von Hippel 2003; Von Krogh et al. 2003). Such convenience in setting up knowledge-based networks of communities makes electronic networks of communities a preferred choice to achieve rapid innovations and problem solving capacities (Kogut and Metiu 2001). In this way, electronic networks of practice demonstrate open collective inquiry practices that initiate, sustain, and synthesize diverse and heterogeneous knowledge resources that are temporally and spatially distributed (Jung and Boland 2009). The particular situation of learning from strangers without sustaining organizational structures, such as the expectation of reciprocity and rewards, sets a clear contextual distinction between learning in online forums and learning in communities, which calls for an independent theory to explain such learning from strangers in online forums. Such learning practices are a participative sport by which a learning agent transforms and constructs knowledge for his or her own purpose

that is unique to the problematic situation and need for action. This can be better understood through in-depth investigation into participating actors' action and interaction rather than accommodating organizational structures.

2.3. Toward a Dialogue-Based Approach to Open Collective Inquiry

Open collective inquiry (OCI) in online forums necessitates truthful efforts to attune differences and overcome the boundaries of heterogeneous local knowledge, particularly in online forum settings where the degree of heterogeneity in organizational structure and resource is unpredictable. The heterogeneity engenders various types of tensions in online communities, such as passion, time, idea divergence, and ambiguous identities which need to be procured constructively through strategic intervention to members' participation and interaction; Otherwise, tensions set harmful constraints hampering knowledge collaboration (Faraj et al. 2011). In this sense, groups of people who are engaged in open collective inquiry are distributed cognition where a set of autonomous agents act independently yet recognize their interdependencies. Organizational learning occurs through a hermeneutic process of inquiry by which individuals exchange their own interpretations in group dialogue (Barker and Kolb 1993; Boland et al. 1994). Participants with heterogeneous experiences and knowledge backgrounds need to engage in dialogue that helps them to learn about each other's perspectives (Gloor 2006; Hemetsberger and Reinhardt 2006). In particular, online forums often lack pre-established formal work structures, strong social networks, and face-to-face interactions that help mobilize tacit knowledge and contextual information. People thus depend more on "dense dialogue" to overcome such constraints for collaboration (DeSanctis et al. 2003). That being said, dialogue is of most significance in researching about dynamics

of open collective inquiry in online forums.

Dialogue is a "meaning-making process" that bridges theory and action — the two ways of knowing. People achieve understandings and generate new ideas while exchanging and questioning thoughts belonging to dialectically opposite domains. It is essentially dialectic, in that it begins with contradictions and differences but seeks consensual agreement by embracing the whole situation despite one's awareness of tension and paradox between opposites (Baker et al. 2005). Good dialogue enables each individual to promote fully own voice and to preserve the differences and the diversities, rather than evaporate them (Barker and Kolb 1993; Kolb et al. 2002). In doing so, people relate themselves to others with different perspective, to influence each other, to incorporate external values, and to modify each other. Through this recursive interaction, a group can incorporate low and unspoken voices into the creation of its values and practices.

Communication activity has been not only a reliable measurement of participants' activity but also a critical precondition for the effectiveness and sustainability of online forums (Markus et al. 2000). Communication activity influences individuals' cognitive and behavioral patterns and is critical for the sustainability of a network of practice (Ridings and Wasko 2010). Members' perceptions of communication quality positively influences the community's task performance (Stewart and Gosain 2006). The effective procurement of communication activity in volume and concentration has been found to be more crucial than resource availability or membership size for the sustainability of a network of practice (Butler 2001). Different strategies of dealing with information

overload influences particular communication patterns (Jones et al. 2004). In this way, communication activity has been recognized as a reliable indicator by which researchers predict the online community's sustainability and learning capacity (Butler 2001; Jones et al. 2004; Kudaravalli and Faraj 2008; Ridings and Wasko 2010). However, such quantitative measurements as thread count, message volume, and the number of participants are limited to capture a dynamic of open collective inquiry embedded in dialogue and even the meaning-making process.

Studies of dialogue-based approach has demonstrated that the way in which conversations are started, continued, and evolved will determine if the dialogue leads to new ideas instead of solely the transfer of information (Fayard and DeSanctis 2008; Isaacs and Clark 1987; Kudaravalli and Faraj 2008; Schegloff 2007; Sherry 2000). Using Wittgenstein's language game, Fayard and DeSanctis (2008) analyze members' language uses in exchanging information to characterize online forums—kiosk, club, neighborhood. For instance, the kiosk-type online forums uses simple and cogent language, the club-type online forums require some rituals and personal gestures to build relationships, and the neighborhood-type online forums use rich language due to diverse professional and personal components sharing experiences, practices and language. Kudaravalli and Faraj (2008) analyzed contents of discussion threads (i.e., issue detail, search detail, situational detail, ask for clarification, reference to others' post, follow-up question, and reference to disciplinary issues) of initiating dialogue structure and sustaining dialogue structure. They found that sustaining dialogue that mediates interactions among members is the most influential on the effectiveness of collaboration

over networks' resource diversity and availability. Singh and Jayanti's (2008) case descriptions demonstrate that generative learning is filled with encouraging, positive, and engaging dialogue, but non-generative learning is hesitant, discouraging, and indifferent of others' problems and suggestions. Jung and Boland (2009) found that discussion threads were punctuated with several dialogic actions that influenced outcomes of the threads' inquiry regarding acquisition of desired knowledge. These studies indicate that dialogic actions of exchanging thoughts and ideas via language shape open collective inquiry processes held by multiple participants who are distributed globally. However, extant IS literature lacks qualitative understandings of dialogue embodying knowledge work (Lacity and Janson 1994), and a dynamics of open collective inquiry and impacts of dialogue on inquiry outcome has been largely unexplored.

Chapter 3. Research Method

This dissertation is oriented toward challenging a black-boxed phenomenon of open collective inquiry in online forums; how people get desired information and knowledge through dialogic interactions with strangers. I raised two research questions regarding this issue; (1) What is a dynamic process of open collective inquiry in online forums; and (2) What characteristics of dialogic actions influence outcome of open collective inquiry in online forums. These research questions necessitate both wide-ranging observation of open collective inquiry and a systemic account for observed phenomena. Therefore, I adopted the grounded theory method because the method not only offers an opportunity for rich description of the phenomenon of interest but also enables researchers to identify relevant constructs that can explicate the phenomenon in a systemic manner (Corbin and Strauss 1990; Eisenhardt 1989; Glaser and Strauss 1967). I conducted the grounded theory at three phases of developmental coding to generate a systematic understanding of the phenomenon (Corbin and Strauss 1990).

I commenced with open coding to surface structural components of a dynamics of open collective inquiry and patterns of dialogic interactions. Then, I organized the codes identified from the open coding to develop dimensions of dialogic action for open collective inquiry. I further corroborated those dimensions and developed classes of each dimension using pragmatic theories such as the speech acts theory (Austin 1962; Searle 1969) and argumentative theory (Toulmin 1958). At the last stage of the coding process, I subsidized possibly interacting classes to increase the reproducibility of the coding process and establish a standardized procedure. Finally, I derived relevant constructs and

variables associated with dialogic action that influence outcomes of open collective inquiry (Eisenhardt 1989; Yin 2003).

In this chapter, I present the reasons for choosing the grounded theory method by discussing relevance of several established research methods. This is followed by a background discussion about the grounded research method, the logic for selecting online forums, and the process of sampling discussion threads. I explain how to apply the grounded theory method using three different phases of coding to address the two research questions raised in the previous section.

3.1. Relevant Research Methods for Analyzing Dialogue of Open Collective Inquiry

In searching for a relevant research method, I consider how well a research method can capture *what I intend to understand* through *what I can observe*. I attempt understand an underlying dynamics of how participants of those dialogues accomplish their inquiry purpose through observable phenomena, here asynchronous textual dialogues of online forums, presuming that the underlying dynamics is embodied in the observable. As online communities become a popular form of the social structures that accommodate diverse social interactions, data available in online communities is utilized as valid research resources. For instance, Kozinets (2002) claims that online communities offer equivalent research opportunities for the conventional ethnography despite its limited access to actual fields and introduces the "netnography" method with some modifications and practical guidelines. Although this study observes interactions among online community members, it specifically focuses on dialogic actions for inquiry and

needs in-depth scrutiny of dialogue itself. There exist several potentially useful research methods for this research purpose, such as discourse analysis, conversation analysis, and argumentative analysis. Although these methods share theoretical grounds and certain technical procedures, they have been diversified for specific preferred applications. In this section, I discuss findings from my attempt to apply these techniques to this study and their misfits to the context of online dialogue. The existing methods were developed to analyze co-located, time-confined dialogue among acquainted members, but dialogues in online communities are asynchronous exchanges of textual messages among spatially and temporally distributed, mostly unfamiliar others.

3.1.1. Discourse Analysis

Discourse analysis refers to a broad range of analysis on verbal and non-verbal communications ranging from language use to conversational interaction (Brown and Yule 1983; Fairclough 2003; Harris 1952; McCarthy 2008; Stalpers 1988). The method attempts to overcome limits of traditional descriptive linguistics in which analysis of speech is conducted a single sentence at a time and, thus, is limited in perceiving further information and the connection between behavior or social situation and language (Harris 1952). Instead, the original discourse analysis presumes that recurring patterns across distributed environments and the connectedness among morphemes are valid empirical evidence characterizing particular social situations such as personality, social group, style, and topic. It identifies morphemes of the text and their patterns through their occurrences within and across sentences. In doing so, the method encourages researchers to recognize "total meaning rather than as the sum of the meanings of their component morphemes" (p.2 Harris 1952). As such, discourse analysis aims to explain

the empirical statement of "how they occur" rather than the tautological statement of "that they occur" (p. 5). Technically, discourse analysis carries out (1) identifying the elements in identical environments and the elements in equivalent environments, (2) determining equivalence classes and segmenting the text into successive intervals, and (3) representing or reconstructing occurrence of text fragments according to their sentence order in the two dimensional array (Harris 1952).

Although discourse analysis originally emphasized retaining original meanings and identifying new meanings during the analysis procedure, it contains more quantitative leanings due to its reduction of equivalence classes distributed in sentences and the formulaic representational apparatus (Stalpers 1988). However, the possibilities for identifying the discourse process of constructing meanings and reproducing them through the text deconstruction technique gains its popularity in qualitative inquiries into various social situations where linguistic activities are considered to be important characteristics of particular social groups or of individual personality (Fairclough 1992b; van Dijk 1993). In doing so discourse analysis goes beyond its original linguistic purpose and establishes itself as an inter-textual analysis through which one can approach various aspects of human behavior. Discourse analysis has further diversified into various methods depending on particular foci of investigation, e.g., dialogue analysis, content analysis, text analysis, genre analysis, and schematic analysis, to name a few (Widdowson 2007). Among such methods, critical discourse analysis is central to the qualitative purpose that discourse analysis originally emphasized. The method explains how "cognitive interaction" bridges the micro- and the macro-levels of social

structure (van Dijk 2003). It “mediates the connection between language and social context, and facilitates more satisfactory bridging of the gap between texts and contexts” (Fairclough 1992b)p. 195).

Critical discourse analysis was further consolidated by critical theories arising from Marxism, the Frankfurt school, Antonio Gramsci, Louis Althusser, Jürgen Harbermas, Michel Foucault, and Pierre Bourdieu (Fairclough 2001; van Dijk 1993). It is the preferred choice for investigating critical sociopolitical discourses where power dominance and inequality are embodied in linguistic behaviors and shape social practice, social activity, and social events (Fairclough 1992a; van Dijk 1993). The method presumes that discourse is a representation of social life and that forms of discourse and of social life are jointly produced and reproduced; discourse is viewed as capable of triggering changes in wider social structures and social practice. Methodologically, critical discourse analysis primarily investigates how dominant social groups occupy genres, structures, and processes of discourse and how they operationalize the discourse either consciously or unconsciously. It also includes inter-discursive analysis of texts in different contexts and fields. The method contrasts or combines patterns and genres of discourse including linguistic styles to identify dominant social entities and social practices (Fairclough 1992a; Fairclough 2003).

3.1.2. Conversation Analysis

Conversation analysis is “a study of talk in interaction” that investigates how meaning is communicatively established in practical, social, and interactional accomplishments (Hutchby and Wooffitt 1998). It is a sub-methodology of discourse analysis. However,

as shown in the idea of "talk in interaction" this method aims to explicate underlying reasoning procedures by which participants are mutually coordinating their sense-making and utterances to achieve orderly and meaningful communication (Sacks et al. 1974). Order does not pre-exist nor does it exist as normative conceptions to perform. The order emerges from interactions during dialogue. The order is primarily recognized as the result of the ongoing coordination among participants who are situated in a dialogue and deliberately attended to achieve the orderliness (Liddicoat 2007). In actual applications of conversation analysis its primary focus is on how the sequential order of talk-in-interaction unfolds, such as the impact of particular word use or the interval between utterances on subsequent dialogue and the consequence of dialogue shaped by the order.

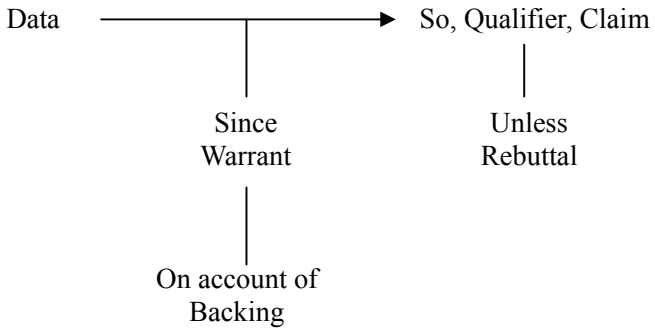
Three areas of conversation analysis are (1) the organization of turn-taking comprised of turn construction and turn distribution, (2) orienting to turn taking to move the dialogue forward (i.e., overlap), and (3) the organization of repair for a variety of breakdowns such as incorrect word selection, mis-hearing, and misunderstanding (Hutchby and Wooffitt 1998). Turn-taking in dialogue is the primary research focus; how turn-taking is accomplished and which participants take turns during doing in their talk (Goodwin and Heritage 1990; Sacks and Jefferson 1992; Sacks et al. 1974). Turn-taking reveals two aspects of participants' interactions. First, taking the next turn indicates that a next speaker understands the prior speaker and that prior turn is possibly completed. Second, the connection between turns reveals how the participants actively analyze the ongoing production of talk in order to determine their situated participation in it. The

conversational sequence is always paired; the next turn occurs as a response to the first. The adjacency pairs tell what is relevant and preferred in the second part and indicate how the next turn is allocated and constructed. Failing the expectation implied in the first part generates breakdowns in dialogue. This necessitates repair for participants to achieve desired completion of the dialogue. Dialogue, in this context, is "a matter of accomplishing actions" rather than a linguistic mechanism of sequencing (p. 43, Hutchby and Wooffitt 1998). Conversation analysis is an iteration of divergent descriptions of individual cases with special attention to deviant cases and convergent abstractions to provide an analytic generalization of the patterns and interactional devices. This analysis builds its account through the retrospective reconstruction of what happened in a setting. Two data sources are transcripts that include the dynamics of turn-taking and the characteristics of speech delivery and on-site observation that complements the transcripts of naturally occurring dialogue.

3.1.3. Argumentation Analysis

Argumentation analysis is a method that is developed upon Toulmin's model of argumentation (Toulmin 1958). He proposed the model as a means of practical reasoning to analyze the ethics behind moral issues, and the model is recognized as an alternative, even powerful and practical, way of reasoning that overcomes the deductive logic system of conventional syllogism (Blair and Johnson 1987; Brockriede and Ehninger 1960). Toulmin introduced six interrelated components of argumentation — claim, data, warrant, backing, rebuttal, and qualifier — that constitute the justificatory function of argumentation depending on how systemically and coherently the six components are laid out to corroborate the probability and acceptability of a claim in

place of truth in the traditional logic system. In this way, the model offers a more dynamic view of argumentation in which the validity of a claim is being established rather than given.



This model of argumentation has been widely utilized toward improved understanding of argument in various contexts of discourse where reasoning is critical to increase the probability and persuasiveness of discourse. For instance, Brockriede and Ehninger (1960) identified three types of argumentation — substantive, authoritative, and motivational — depending on what kind of claims — designative, definitive, evaluative, or advocative — are made and substantiated by other components. Jackson and Jacobs (1980) use this model of argumentation to characterize the structure of conversational argument. They view disagreement as a discrepancy or a misalignment between the first part of an adjacency pair and the second part that is caused by any defect in the proposition or performatives. They propose repairing the disagreement by negotiating to justify their statements as unobjectionable. A similar application of the model of substantive argumentation is found in legal dialogue where reasoning is unfolding through dialogue rather than presented at once (e.g., (Bench-Capon 1998). The structural components of reasoning provide implications to computer science in designing mediated human communications (e.g., (Reed 2006).

This model also lends itself to the development of a research method that provides a systemic guide to investigate various aspects of argumentation. In a nutshell, good argumentation entails coherent organization of structural elements, which embraces essential elements, distributes them properly, completes connection among every sort of argument, and deploys argument with proper reasoning (Liakopoulos 2000; Mann and Thompson 1987). In coherent argumentation every statement and its elements find an intended role and meaningful function. Toulmin's argumentation model can be applicable to analyzing conversation by examining how statements are connected consistently and coherently (Liakopoulos 2000). In an instance of question-answer dialogue, how to make questions sound interesting and worthy of reflection and how to propose probable and convincing answers influences the outcome of learning (Brown and Walter 2005). However, its application to dialogue is limited in capturing the practical reasoning that is central to the model of substantive argumentation, and, instead, it focuses on structural coherence that is similar to conversational analysis. Overall, argumentation analysis remains flexible and open for modification relevant to varying contexts of discourse.

3.1.4. Critiques on the Relevance of the Established Research Methods

In attempting to apply the above-discussed methodologies to dialogue in online forums, I recognized some misfits. Table 1 provides a summary of the methodologies discussed above and their inadequate relevance. The foremost cause of the i comes from the fact that dialogue in online forums is asynchronous discrete exchange of textual messages among distributed anonymous participants whose participation is unpredictable, whereas

the established methods were developed in the context of co-located dialogue. This characteristic defies some basic assumptions of the conventional methodologies.

Table 1. A Comparison among Research Methods for Analyzing Dialogue

	Discourse analysis	**Conversation analysis**	**Argumentative analysis**
Foundational theory	Descriptive linguistic & critical theories	Speech acts theory	Toulmin's model of substantive argumentation
Study focus	Discourse and context	Functional condition of dialogue	Practical reasoning
Analysis focus	Construction of meaning and dialogue order	Management of dialogue flow (i.e., turn-taking, adjacency pair, and error correction)	Structure of substantive argumentation
Preferred topic of investigation	Power and dominance	Coordination and allocation of turn-taking	Justification of argument and
Primary cause of irrelevance	Unclear condition of inequality or confrontation of power and counter-power	Unlimited time resource and discrete access to dialogue	Continued texts & Incomplete reasoning distributed among participants

First, the time span of dialogue in online forums is mostly extended over several days or more, even several months. It is common that a posting receives fewer and fewer replies as the message is pushed backward by new messages. However, by monitoring the posting or by receiving alert messages of new replies added, someone who is interested in it can stay on the posting threads as long as he wants. Thus, there exists little time-resource limitation. This is the most critical difference between synchronous dialogue and asynchronous one. Synchronous dialogue, mediated or unmediated, is taking place during a limited time and constrained by time pressure. Time is considered as a limited resource that needs to be managed strategically and whose occupation can convey power and dominance. Tenets of conversation analysis are primarily about how to allocate the limited time resource fairly and efficiently to participants in the form of order

coordination so that the conversation makes the best out of the limited time frame. The performance of a conversation facilitator is examined in terms of how efficiently the facilitator enforces turn-taking and the sequence of conversation. An adjacency pair indicates what is assumed to be given next in a sequential order of talk in interaction. A repair mechanism focuses on how to correct the discrepant adjacency pair and achieve a coherent conversation effectively.

To the contrary, asynchronous dialogue in online forums does not have temporal constraint and does not unfold sequentially. This generates different structures of conversation and patterns of participatory interaction (Cummings et al. 1995; Gruber et al. 1994; Lebie et al. 1995). Participation is not linear but discrete. Participants do not engage in particular dialogue continuously and are not forced to contribute; they determine when to come in and what to contribute of their own. Turn-taking becomes flattened, in that each turn is asynchronously and linearly connected without overlapping. Gap and interval, an important mechanism of the sequential order, becomes almost meaningless. Interval between turns is generated not merely by time for sense making and preparing the next turn but also affected by participants' availability in online forums. Members can expend as much time and effort to construct reply messages and be selective on which part of the dialogue they will respond by linking or quoting (Herring 2001). The prior dialogue remains available, which allows participants to respond appropriately without continuous attention or expending cognitive effort to retain a particular part of dialogue. Breakdowns due to slips of tongue and mishearing common in face-to-face dialogue are unlikely. Thus, such analytic apparatuses as turn-

taking and adjacency pair that are derived based on limited time resource and a linear sequence of interaction is irrelevant in online dialogue. Likewise, any dominant occupation of dialogue itself does not have much correlation with power in online forums, which instead entails more in-depth qualitative investigation.

Second, discourse analysis is based on a sociolinguistic perspective and is relevant for identifying patterns of social interactions and practices. Identification of community members is one of the popular research topics of discourse analysis based on such theoretical lenses as language game and genre (Bouas and Arrow 1995). Orlikowski and Yates (1994) identify a genre repertoire in an organization's communicative action and use it as an analytic tool to investigate an ongoing process of shaping work practice. Online forums are a popular social structure through which members can develop social identities and relationships over time despite their anonymity and the less personal textual communication mode. Fayard and DeSanctis (2008) adopt Wittgenstein's language game concept and characterize online forums based on the particular language uses for learning. The use of well-liked, easily understandable expressions demonstrating a community's identity, such as the choice of words, metaphor, and similes, facilitates quick learning and expands shared languages. Styles represent emotion and motivation such as hope, suspicion, and respect and reveal opportunistic behavior showing preemptive defense against potential assaults. The use of 'we' indicates empathetic mutual commitment and collaborative relations (Brown et al. 1987; Dillon 1990).

However, the present study directly aims to investigate a process of open collective inquiry through which individual members obtain desired working knowledge from interactions with others, rather than how sociolinguistic practices influence and reflect different types of open collective inquiry. The level of analysis is a single discussion thread within which an episode of open collective inquiry takes place. Although I replicate such analyses with 80 cases from three online forums (Yin 2003), the level of analysis is not compatible with capturing influences of social practice on particular online forums. Thus, the discourse analysis does not suit my study focus. Furthermore, online forum members tend to remain strangers to one another using aliases and limitedly exposing their personal information. Although members present different opinions on problems and solutions and compete over better workability, conflicts among groups and power dominance are difficult to discern within a discussion thread.

Third, open collective inquiry in online forums is held by multiple participants distributed temporally and spatially and is achieved through their interactions. The purpose of open collective inquiry is to construct working knowledge, which is necessarily associated with reasoning processes to evaluate validity and trustworthiness of proposed statements. Argumentation analysis offers a means of studying the reasoning process and structure. As dialogue flows discursively, each thread consisting of an episode of open collective inquiry dialogue is generally incomplete in terms of reasoning structure. Considering such discursive flow, argumentation analysis tends to resemble conversation analysis. For example, Jackson and Jacobs (1980) consider breakdowns in conversational argument as a disagreement on the first part of an adjacency pair and

seek for repair through confrontation and resolution of the disagreed argumentative statement. However, I found it hard to apply this method to nonlinear asynchronous dialogue of open collective inquiry in online forums. Tracing the discursive flow at the level of *argumentative components*, such as claim, backing, warrant, ground, rebuttal, and qualifier, not only generates too much complexity in connections among threads but also shows many missing or incomplete connections. Only a small-size case study can handle the complexity with adequate details of argumentative structure (e.g., (Salmon 1995), or a larger-scale study can use particular *argumentative components* as a means of characterizing distinct discourses on particular social issues.

Although the analytic apparatuses of these established methods still offer valid lenses to investigate phenomena in technology-mediated discourses, they are limited for the purpose of the present study. Not only open collective inquiry for knowledge construction is not a preferred application of these methods, but also dialogue of open collective inquiry is multidimensional. From my prior attempts to adopt each of the three methods, I realized that an exclusive use of one of these methods ended up losing significant aspects of open collective inquiry, even with significant modifications. This exacerbates constraints set by their irrelevance. Thus, I proceed the present study adopting grounded theory to develop a systematic and theoretical account of the phenomenon of the study from empirical observation (Martin and Turner 1986). Since I choose the grounded theory method after going through these research methods and recognizing their interconnectedness in understanding open collective inquiry, my undertaking of the grounded theory tends to be more theoretically bounded and systemic

rather than purely explorative.

3.2. Research Methodology

3.2.1. Grounded Theory

Due to this lack of proper research methods and theoretical models for explicating the dynamics of open collective inquiry, I adopt the grounded theory method using multiple cases to develop concepts and theoretical explanations (Corbin and Strauss 1990; Eisenhardt 1989; Glaser and Strauss 1967; Urquhart et al. 2009; Yin 2003). I also intend to develop a more effective method of analyzing discourses in the contexts of knowledge construction. Although grounded theory allows greater flexibility to researchers, the method has explicit procedures for data collection and analysis both of which are closely interrelated (Corbin and Strauss 1990). Eisenhardt (1989) proposes a detailed guideline for grounded theory procedures for information systems research. Urquhart et al. (2009) propose five guidelines for grounded theory studies: constant comparison, iterative conceptualization, theoretical sampling, scaling up, and theoretical integration. I adapt to Eisenhardt's (1989) guideline (p. 533)and have outlined the present research procedure in Table 2. The first part is addressed in the previous literature review section, and the rest of the procedure is discussed in the following sections.

Table 2. Building Theory from Case Study Research		
Steps	*Activity*	*The Present Research*
Getting started	Definition of research question	(1) What is a dynamic process of open collective inquiry in online forums; and (2) What characteristics of dialogic actions influence outcome of open collective inquiry in online forums
	Possible a priori constructs	Dialogic action/interaction, inquiry outcome
Selecting cases	Neither theory nor hypotheses	No theory for a dynamic process of open collective inquiry nor its influence on outcome
	Specified population	Inquiry-motivated online forums
Crafting instruments and protocols	Multiple data collection methods	Discussion threads
	Qualitative and quantitative data combined	Data transformation through multilevel coding (explorative open coding → axial coding→ systemic selective coding)
	Multiple investigators	Inter-coder reliability test on randomly selected samples
Entering the field	Overlap data collection and analysis	Incremental data sampling, multiple iteration during open coding, and cross-check during developmental coding
	Flexible opportunistic data collection	Incremental sampling
Analyzing data	Within case analysis	How open collective inquiry dialogue unfolds
	Cross case pattern search using divergent techniques	General themes of open collective inquiry process and recurring patterns of open collective inquiry in distinct conditions
Shaping hypotheses	Iterative tabulation of evidence	List of coding scheme
	Replication, not sampling, logic across case	Replication with 80 dialogues from three online forums
	Search evidence why behind relationships	Role of actors, inquiry context
Enfolding literature	Comparison with conflicting literature	Knowledge contribution perspective and organizational structure perspective
	Comparison with similar literature	Dialogue-oriented approach and organizational learning literature
Reaching closure	Theoretical saturation when possible	Conceptual framework and theoretical model

3.2.2. Purposive Sampling

Grounded theory carries out samplings based on concepts, theory properties, dimensions and variations, and thus, selects purposively cases that consistently represent such characteristics through observable actions and interactions (Corbin and Strauss 1990; Eisenhardt 1989; Yin 2003). The present study aims to explore a dynamic process of open collective inquiry by analyzing dialogue embodying the process. I considered online user forums for three reasons. First, online forums are a popular social structure that is dedicated to open collective inquiry ─ multiple participants are voluntarily committed to resolving problematic situations. Second, researchers can investigate open collective inquiry processes with intense focus. Members of online forums interact with others mostly through textual and asynchronous communication to overcome any constraints set by uncontrolled organizational structure and practice. Online forums thus provide abundant data of dialogue that is less influenced by social and interpersonal relationships. Third, online forums have been popularly been utilized for learning and inquiry in various contexts. Thus, a grounded theory developed from online forums obtains practical implications for developing open collective inquiry systems using such platforms (e.g., ideation software and design technology tool).

Provided these benefits, I entered three online forums that were all dedicated to open collective inquiry to generate working knowledge for problematic situations, but each of the forums had distinct conditions for members' access to problem space, i.e., to what extent users can modify sources of problem for solution. I presented their descriptives in Table 3. Online forum A belonged to an open source community that allowed, even

encouraged, members to access the software source code to modify for their own needs. The community utilized such members' inquiries as a critical resource for further software development. Online forum B was a part of a proprietary software user community. Users of this forum inquired about how to apply, modify, and create scripts for particular purposes and maintained a public repository of open source scripts whose workability was verified. The script repository was open for users' modification and for users to update, whereas the software was not. Online forum C was a proprietary software user forum where users had no access to the software source code and only inquired about how to use features and functions of the software.

Table 3. Descriptives of Sampled Online Forums

	Online forum A	Online forum B	Online forum C
	Open source	Semi-open source	Proprietary software
N of threads	55,854	1,187	753 (14,642)
N of replies	194,722	3,794	2,594 (64,463)
Ave. N of replies	3.49	3.20	3.4 4 (5.4)
N of sampled threads	40	20	20
N of replies in samples	878	416	374
Ave. N of replies per sample	29.3	20.8	18.7

I purposively sampled discussion threads in an incremental manner from each of the three online forums. I carried out sampling by two criteria: most replied to threads and most viewed threads. The number of replies is viewed as an indicator of active participation in online forums (Butler 2001; Jones et al. 2004; Kudaravalli and Faraj 2008; Ridings and Wasko 2010). Thus, I could expect to observe a wide variety of actions that participants contributed to open collective inquiry. More viewed threads indicated two issues: why people entered these threads but left without contribution and whether these threads were referred to as working knowledge resource.

I started sampling with a highly sustainable user forum (Online forum A) in an open source community because such open source communities were considered as exemplars of collaborative learning (Awazu and Desouza 2004; Faldetta 2002; Lee and Cole 2003; O'Reilly 1999). Members of open source communities continuously interact with one another to provide criticism and error correction through peer-monitoring, bottom-up community structure (Awazu and Desouza 2004; Lee and Cole 2003; Markus et al. 2000). They benefit from prompt feedback, a global testing pool, independent peer review, highly qualified contributors, and self-selected and motivated developers (Feller and Fitzgerald 2002, Lerner and Tirole 2000). These activities are key features of open collective inquiry. Furthermore, hardware issues associated with open source operating systems have a wide variety of problems, so I intended to avoid being biased by topic specificity to some extent.

Online forum A had been active more than 10 years and populated with 55,854 threads receiving 194,722 replies at the time of my initial sampling. Each thread received 3.49 replies on average. I sampled twice. At the initial sampling, I chose the 50 most replied to threads with which I carried out a preliminary case study (Jung and Boland 2009). Then, I comprised a pool of 100 threads including the initial 50 sampled threads. Among them, I chose the 25 most replied to threads and the 15 most viewed threads. The 40 sampled threads received 1,023 replies in total and 25.6 replies on average. I carried out initial open coding with these samples through three or more iterations on each thread.

I increased the sample size by adding more threads from two other user forums. With the new addition I intended not only to confirm the initial open coding scheme while opening to further revision but also to increase the generalizability of the initial open coding scheme developed in the context of open source community. Thus, I added two online forums, one from a semi-open source context (Online forum B) and the other from a proprietary context (Online forum C). Online forum B had 1,187 treads receiving 3,794 replies, and each discussion had 3.2 replies on average. I sampled the 20 most replied to threads. When there were multiple threads at the cutoff line, I chose the most viewed ones. The 20 threads received 416 replies in total and 20.8 replies on average. Online forum C was populated with 14,642 threads receiving 64,463 replies in total and 4.4 replies on average. Due to the large number of threads, I made a pool of 753 threads made during a three-month period. These threads received 2,594 replies in total and 3.44 replies on average. From the pool, I sampled 20 most replied threads receiving 374 replies in total and 18.7 on average. Overall, 80 threads from three online forums with distinct contextual conditions were sampled for the present study. The sampled online forums demonstrated a similar disparity of receiving replies; 1.6 percent of threads received 11 percent of total replies in Online forum B, and 2.7 percent of threads received 14.4 percent of total replies.

3.2.3. Data Analysis

Corbin and Strauss (1990) propose three basic types of coding ─ open, axial, and selective ─ that involve different levels of refinement and systemic organization of data. Open coding is the most basic interpretive process by which researchers break down data analytically by iteratively comparing similarity and differences. In doing so,

categories for specific properties and dimensions emerge, and researchers refine initial research questions. In axial coding, researchers further develop categories and subcategories to organize systemically the full range of variations recognized during open coding. At this stage hypotheses can be critically evaluated against data to provide explanation on relationships between particular conditions and actions. Selective coding is the process of identifying a "core" category that captures a key phenomenon of the study. Each of categories and subcategories obtains conceptual density and develops systematic relationships with one another. During this coding a grounded theory can achieve explanatory power and generalizability. The three coding processes are developmental in that the abstraction levels of concepts increase as analyses proceed from open coding to axial coding to selective coding.

Open Coding

I segmented the text of 80 sampled threads at the sentence level and coded the text segments for types of purposeful actions for open collective inquiry. When a sentence closure was unclear or when a sentence included more than one purposeful action, I segmented such text by phrases. Graphical icons, members' signatures, and code sets were excluded from coding, because these elements lacked significant intention or meaning by themselves. I came up with 5,572 segments of text identified for analysis as units of coding: 3,263 from Online forum A, 1,206 from Online forum B, and 1,103 from Online forum C. I used Atlas/ti 6© for the open coding. Below is a snapshot demonstrating how open coding was carried out (Figure 2). To make codes more visible, I separated sentences by different lines when the sentences in a paragraph needed to be coded differently (e.g., the second paragraph of the example). In this example, the first

paragraph was divided into three segments; name-calling is one segment that intends to designate the reply to a particular person's prior statement; an appreciation was made for a particular person; and the last segment contradicted a prior statement for its irrelevant conjecture and invalid outcome.

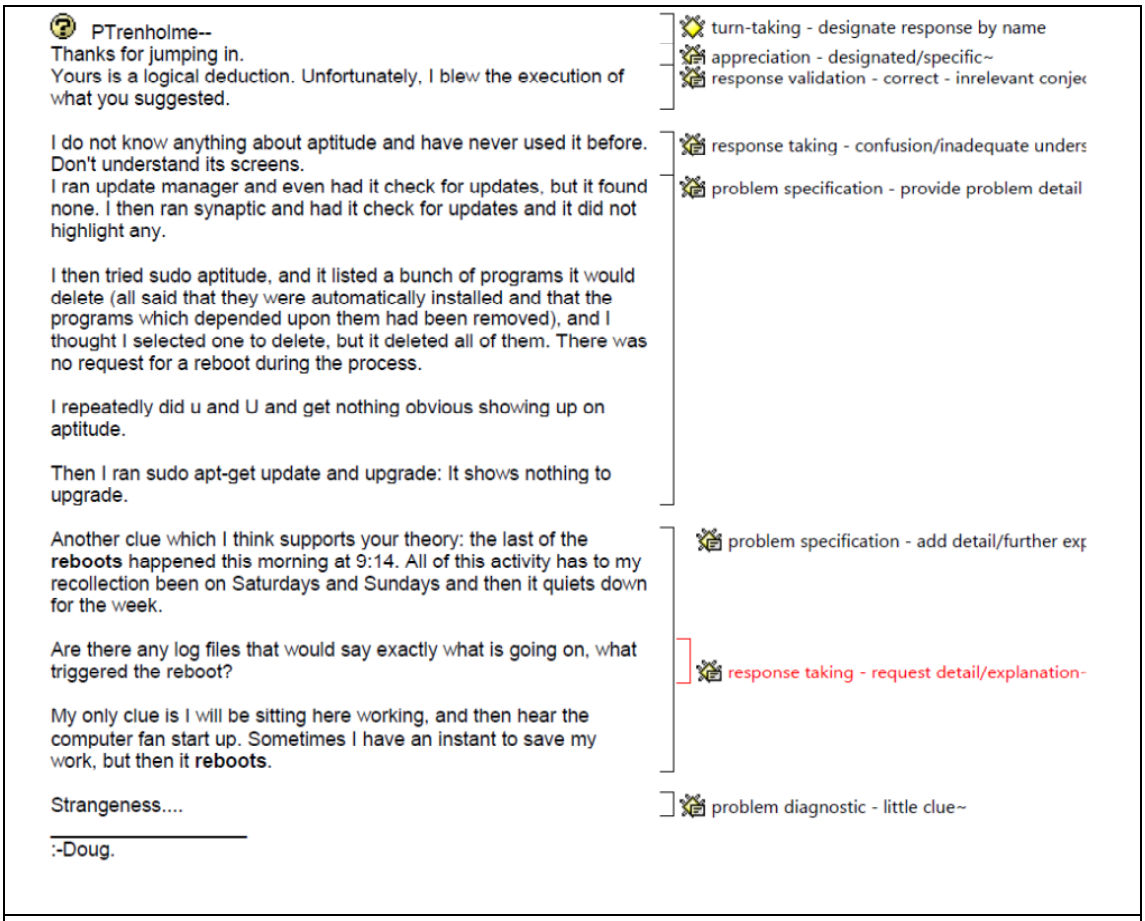


Figure 1. A Snapshot of Open Coding

I came up with 195 codes of dialogic actions from open coding. A list of the codes and the number of segments identified by each code is demonstrated in Appendix A. The 195 codes were examined for similarities and differences regarding distinct purposes of action. I tentatively sorted these codes into 21 categories. For example, "inquiry dis-justification" emerged as a common theme from such dialogic actions that contradicted

the inquired problematic situation for being avoidable, general, incorrectly presumed, insignificant, irreparable, or unproblematic.

Axial Coding and Theoretical Integration

I classified the 21 categories identified from the open coding into seven types of action domain based on their distinct purposes: (1) to initiate inquiry, (2) to maintain commitment, (3) to manage dialogue flow, (4) to manage inquiry process, (5) to frame a problem, (6) to construct solutions, and (7) to validate workability. Then, I further identified three dimensions of dialogic action regarding how a dialogic action performs its purposes —*action performed*, *content of action*, and *argumentative component*. Since the premise that a dialogic action performs a purpose is central to the speech acts theory (Austin 1962; Searle 1969), I adapted the theory to characterize classes of dimensions of "*action performed*" and "*content of action*" drawing upon performatives and propositional content, respectively. An in-depth introduction of the theory and the implications to the present study will be presented in Chapter 4. I selected five types of performatives from Austin's categorization and Searle's: *declaratives*, *expositives*, *directives*, *commisives*, and behavitives because some of their categories overlap (e.g., verdictives and *declaratives*, behavitives and *directives*, *expositives* and representatives, and *commisives*) and expressives of Searle's category was rarely observed in the present inquiry-motivated dialogue (See Table 9-A and B for detailed description of their performatives). *Content of action* is viewed as propositional content that indicates or implies meaning. I extracted *content of action*, both implicit and explicit, from the 195 codes identified from open coding and obtained 145 types of *content of action*.

For example, a text segment, “Right. John doesn't know what he's talking about” was coded as flaming based on inadequate/invalid trustworthy in open coding. In axial coding, a purpose of the segment was categorized as an action domain that builds and maintains commitment because the sentence rejected someone’s commitment. The *action performed* was categorized as behavitives because the statement was given as a reaction to another’s prior statement and contained an attitude toward the statement. Although the statement did not contain propositional content in a clause, meaning delivered by the behavitives clearly showed a hostile attitude toward John’s prior statement and it was rejected for inadequate trustworthiness. The distrust implied in the segment was further substantiated with contradictory evidence from the participant’s own personal practice: “IEEE 1394 tops out at 786 Mbit/sec and USB 2.0 at 480 Mbits/sec. In practice, firewire mass storage devices aren't any faster.” I categorized such substantive elements as a dimension of the *argumentative component* drawing upon Toulmin’s argumentation theory. Among the six components of argumentation that Toulmin originally proposed ─ claim, warrant, data, backing, rebuttal, and qualifier, I excluded claim and rebuttal because these components could be adequately comprised of *action performed* and content. A performative verb and a clause adequately consist of a statement of claim, and rebuttal is viewed as a counter-argument of the statement that can be independently stated without being subordinated as an unless-clause.

With these four dimensions I generated a worksheet for axial coding. I arranged text segments identified for open coding in the worksheet by marking their thread

identification numbers in designated cells representing the four dimensions. The axial coding worksheet and an example of axial coding were presented in Appendix B. This analysis showed the distribution and clustering of dialogic actions, which could be used of collective as a roadmap inquiry processes. I also used this axial coding scheme as an intermediary to transform the interpretive results from open coding into more condensed selective coding.

Selective Coding

Grounded theory has been criticized for the lack of reproducibility and verifiability, and researchers have attempted to overcome the weakness by establishing a standardized procedure and the strict compliance throughout the procedure (e.g.,(Corbin and Strauss 1990; Eisenhardt 1989; Urquhart et al. 2009). In addition to the explicit deployment of the procedure, I aimed to improve reproducibility and verifiability of the present study by introducing an easily replicable analytic framework. I used selective coding as a way to develop a replicable coding scheme and attempted to develop constructs and conditions that are related to the patterns of open collective inquiry actions.

To condense the current large variance in each dimension, I subsidized possibly interacting categories in each dimension. I condensed the seven categories in the action domain into six with new labels for some action domains: to initiate inquiry, to maintain commitment, to manage inquiry flow (combining action domains to manage dialogue flow and to manage inquiry process), to frame a problem, to construct solutions, and to validate workability. I collapsed the action domain to manage dialogue flow and the action domain to manage inquiry process because both of them are associated with

organizing open collective inquiry processes. The five categories of the *action performed* dimension were preserved because their distinctions were theoretically proven. I reduced 145 types of the *content of action* applying three conditions ─ felicity, reflection, and interaction type (Table 4). Numbers in parentheses are the number of codes identified for each category. Austin (1962) proposed the notion of felicity in place of the truth of an utterance. An utterer should be heard by a hearer, and the utterer's intention needs be understood by the hearer. This is instrumental to make the speech act felicitous or satisfactory. When an utterance is irrelevant, ill-mannered, or baffling, doubts arise and the speech act becomes void. The felicitous condition is the criteria that must be satisfied for a speech act to achieve its purpose.

Table 4. Subsidized Categories of the Content of Action

		Condition of felicity				
		Felicity		Infelicity		Non-felicity
		Less—Reflection—More		Less—Reflection—More		
Interaction type	Response giving	Constructive (25)	Supportive (17)	Unsupportive (20)	Confused (11)	Conversational (18)
	Response taking	Compliant (4)	Assimilating (14)	Declining (10)	Challenging (25)	

Whether or not the condition of felicity is met shapes subsequent exchanges of speech acts in the context of dialogue. Adapting this notion of felicity, I distinguished three categories of *content of action* that are given three distinct felicity conditions: felicitous, infelicitous, and non-felicitous. The three categories were further considered based on two directions of interaction ─ response giving and response taking ─ and the extent of reflection that an individual participants exercise to create a statement. I discussed how

these three conditions were developed in Chapter 4 in detail.

3.2.4. Inter-coder Reliability

Reliability refers to "the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions" (Hammersley 1992 in Silverman 2001). Although positivist notions of reliability, such as quixotic reliability, diachronic reliability, and synchronic reliability, are somewhat inappropriate for qualitative studies that emphasize authenticity (ibid.), reliability is still a critical issue of a qualitative research to establish its validity and objectivity. Since the present study conducts grounded theory using text data, inter-coder reliability is a standardized way of measuring reliability (Corbin and Strauss 1990; Glaser and Strauss 1967; Kolbe and Burnett 1991; Neuendorf 2002; Silverman 2001). Inter-coder reliability, or inter-rater agreement, refers to the extent to which independent judges make the same coding decisions in evaluating the characteristics of messages and is measured by the extent of agreement among multiple coders on an identical object to be coded (Lombard et al. 2002). Whereas quantitative applications of content analysis require statistically rigorous measurements, purely qualitative text analysis that aims to develop thematic coding schemes often conducts the test using percent agreement (Boyatis 1998). Furthermore, grounded theory emphasizes ongoing agreements among multiple coders throughout coding procedures and iterative revisions of coding schemes (Corbin and Strauss 1990).

The present study addressed reliability by employing multiple discussion threads from multiple sites so that a primary investigator can observe different occasions. During the

open coding, I discussed coding schemes with my advisor regarding its plausibility and revisited the coding scheme to revise them (Corbin and Strauss 1990). I iterated revisions of coding scheme more than three times for each discussion thread, and a few exceptionally heated discussion threads received more iterations of revision. Inter-coder reliability is measured by comparing how consistently multiple coders apply established codes to sampled text units. Thus, I used the most refined coding scheme developed from the final selective coding procedure (See Appendix C).

I chose four discussion threads out of 80, two from Forum A, one from Forum B, and one from Forum C. Each discussion thread was pre-segmented in the same way I did, and 199 segments of coding were derived in these four threads. Two coders helped. I introduced and explained each dimension and classes, and carried out a training session with a shorter example. Then, I discussed their coding results to refine their understanding. The training took about an hour and a half. After the training, I supplied them with a coding guide and the pre-segmented transcripts, and the coders conducted coding independently. I present the percent agreement among coders in Table 5.

Table 5. Percent Agreement

Dimensions	Coder 1*2	Coder 1*3	Coder 2*3	Coder1*2*3
Action domain	77.4%	61.3%	58.8%	53.8%
Action performed	71.6%	72.1%	65%	58.4%
Content of action	51.8%	50. 3%	46.2%	37.2%
- *Felicity condition*	*76.9%*	*72.9%*	*67.8%*	*63.3%*
- *Reflection condition*	*76.4%*	*71.9%*	*72.4%*	*58.8%*
- *Direction condition*	*71.9%*	*71.4%*	*60.8%*	*53.3%*
Argumentative component	45.9%	-	-	-

The dimension of action domain has six classes. The percent agreement among the three

coders was 53.8 percent. Specifically, Coder 2 achieved 77.4 percent agreement with Coder 1 (Author), and Coder 3 did 61.3 percent. A large portion of disagreement occurred between 'action domain to construct solutions' and 'action domain to validate workability.' Combining the two classes, the agreement rate increased 83.9 percent and 67.8 percent, respectively. This indicated that the two domains were highly interacting. This makes sense in that processes of constructing suggestions and validating their workability are iterating, not sequential, until participants derived a satisfactory working solution. The dimension of *action performed* that has five choices of coding showed 58.4 percent agreement among all three coders; Coder 2 agreed with 71.6 percent of Author's coding, and Coder 3 did 72.1 percent. The dimension of *content of action* has nine classes in three conditions. Due to its complicated structure, the three coders did not achieve an adequate percent agreement. I examined percent agreement of each of the three conditions — felicity, reflection, and direction — separately, and three coders' percent agreement increased significantly. This suggests that the organization of the three conditions needs be simplified and focused depending on what type of conditions a study intends to study. The dimension of *argumentative component* was a bit problematic. Different from the other coding dimension, this dimension required a coder to identify any presence of *argumentative components* and code among five types classes. This seemed to put significant confusion on coder, and Coder 3 identified only a few out of 199 segments. I compared Coder 1's coding outcome with Coding 2. Coder 1 identified 37 uses of *argumentative component*, and Coder 2 did 62 uses. The percent agreement could be improved by providing only segments containing *argumentative components* identified by Author. For example, the percent agreement on segments that

Coder 1 identified and coded was 45.9%.

Overall, the percent agreement among all three coders was relatively low. In particular, those of the dimension of content of action including nine categories and of argumentative components were critically low. Even one of the coder did not identify argumentative components to code. To investigate causes of the low percent agreement and seek for ways to improve the percent agreement, I decided to carry out an extended discussion session with the coders. Due to coders' limited time availability, I chose one among the four discussion threads used for the percent agreement measure, as it demonstrated the lowest percent agreement for review. I assumed that the thread contained the most of confused and disagreed cases, and thus the improvement achieved in this discussion thread could be applied to other discussion threads. The two coders and I met three times for 6 hours in total. During this session, we reviewed the coding guideline again to get clearer understanding of code description. Then, we went through our coding together. For all discrepant coding, each of us first explained why one thought it relevant during the initial coding, negotiated it together, and then decided either to keep one's original coding or to change it. Table 6 showed how much the percent agreement was improved through the discussion.

Table 6. Improved Percent Agreement

Dimensions	Coder 1*2		Coder 1*3		Coder 2*3		Coder1*2*3	
	Before	After	Before	After	Before	After	Before	After
Action domain	80.9%	97.9%	59.6%	95.7%	51.1%	97.9%	46.8%	95.7%
Action performed	70.2%	91.5%	63.8%	91.5%	51.1%	93.6%	46.8%	91.5%
Content of action	36.2%	91.5%	31.9%	91.5%	25.5%	89.4%	12.8%	87.2%
Felicity	*76.9%*	*95.7%*	*72.9%*	*93.6%*	*67.8%*	*93.6%*	*63.3%*	*93.6%*
Reflection	*76.4%*	*95.7 %*	*71.9%*	*100%*	*72.4%*	*95.7 %*	*58.8%*	*95.7 %*

The discussion thread contained 47 segments of text. In the original coding, we achieved below the average percent in all categories. However, we achieved more than 90 percent of the percent agreement in all dimensions through the revise session. Coder 1 (Author) changed 8.5% of her original coding in the action domains and 10.6% in the action performed, while adjusting original descriptions. Coder 2 changed 12.7% of his original coding in the action domains and 21.3% in the action performed. Coder 3 changed 36.2% of his original coding in the action domains and 31.9% in the action performed. The early stage of the review session, we needed to revisit the original coding guideline to improve it for clearer format, description, and wording. The revised coding guide is attached in Appendix D.

First, the boundary between the action domain to construct solutions and the action domain to validate workability was not solid for actions that reported unsuccessful or partially successful outcomes of experimenting with suggested solutions. One of the coders questioned that unsuccessful outcomes reported could be used for deriving alternative suggestions and be a part of constructing solutions. Thus, I modified the description of the action domain to construct solutions limited to those statements that intend to exchange solutions and opinions about the solutions (i.e., to suggest potential solutions, and to support/contradict such suggestions) and labeled it as action domain to *negotiate* solutions. Likewise, I modified the description of the action domain to validate workability into such statement that intend to confirm or disconfirm workability of suggested solutions or extend them (i.e., to report outcomes of testing suggested solutions, to provide summary/explanation of solutions) and labeled it action domain to

confirm workability. Noticeably, I modified some of original labels during revision. I keep the original labels in appendices but used the revised labels hereafter to minimize confusion.

Second, the dimension of the content of action that included nine categories was the most serious source of discrepancy. Coders complained that adjective naming of the nine categories sounded predetermined and that they tended to be biased by their ordinary use of those adjectives rather than following operationalized descriptions given in the coding guide. As such, I asked them to assess directly whether each of the three dimensions — felicity, reflection, and direction — existed. For example, "My point is that it is a removable drive, so looking at /etc/fstab is a dead end" that corrected one's misunderstood prior statement was given under the conditions of infelicity, reflection, and response giving. That way worked better, but the coders reported that distinguishing the condition of direction, either response giving or taking was difficult and even arbitrary because the two were tightly intermingled. I concurred their opinion in part and judged that the condition of direction itself would not say much about to understand a process of open collective inquiry. Thus, I dropped the condition and derived five combinations using the two remaining conditions — felicity and reflection: felicity-reflection, infelicity- reflection, infelicity-reflection, infelicity-non-reflection, and non-felicity.

Third, the multidimensional coding scheme that asked the coders to code each segment four times using 21 categories in total generated a significant burnout to them.

Furthermore, the dimension of argumentative component needed them not only to code but also assess any presence of those components obviously overburdened them. Although I believed that using the argumentative components were important to generate content of action, some components like data, backing, and qualifier were too obvious to code by their presence. For example, code set and attachment files are data components, hyperlinks to reference are backing components, and particular adverbs are qualifier components. Those needed more of refreshed careful observation rather than human intervention. One of the coders tended to see personal warrant and general warrant as content of action rather than sub-component of it. Thus, I determined to leave the fourth dimension optional.

Overall, the revisited percent agreement achieved high score. Although it requested some adjustments in description and wording and the reduction of categories in the dimension of content of action, those modifications do not hamper or contradict the original coding scheme. Thus, I believed that my coding guarantees a proper degree of objectivity. However, future study can ensure the greater objectivity of qualitative analysis by conducting an a priori pilot percent agreement and a follow-up review session and comparing it with a posteriori evaluation, when coders cannot code all data together. That way, coders can have a chance to attune potential discrepancy and use percent measurement not only as a measurement of the objectivity but also as a measurement of how coders abide by consented criteria.

Chapter 4. Findings-Part 1

I present findings in two chapters. In this chapter, I report findings that address the first research question on a process of open collective inquiry in online forums. I characterize each action domain and explain how the six types of action domains constitute open collective inquiry processes. I seek for a more systemic explanation of the processes using the three dimensions of dialogic action — *action performed*, *content of action*, and *argumentative component* — that were observed within and across the six action domains. I consolidate these dimensions further adapting to pragmatic theories such as speech acts theory and the theory of argumentation.

4.1. A Dynamic Process of Open Collective Inquiry

As implied in the term, discussion threads, dialogues in online forums have often been viewed to elongate sequentially; that is, an original posting is followed by a sequence of replies one by one. However, I collapsed such linear temporality in the present study because such sequential order of dialogue in online forums cannot be controlled intentionally and managed coherently. Individual participants determine what point of a dialogue to enter into, what aspect of the dialogue to respond to, and when to leave it all by themselves without any pressure of obligation to others. Intervals between responses are determined largely by the time of participants' access to online forums. Thus, an OCI initiator has little control over the dialogue developed around his initial problem. In this way, dialogues in online forums are subject to be fragmented, which make them more like a collection of soliloquies or a collection of small isolated groups' talks than a coherent interactive dialogue with a convergent closure. Figure 3 illustrates an example

of such dialogue fragmentation using one of dialogues sampled for the present study. An original posting (R1) was directly followed by eight replies that provided ideas distinct from prior replies. Only four of these replies (R2, R6, R13, and R20) generated interactive exchanges of responses over coherent issues, whereas the rest of them were simply declined (R22) or unattended (R17, R30, and R33) by others. Even within an elongated thread, replies (R10 and R12) were given only to respond to particular replies (R8 and R7 respectively) without significant continuity with prior replies. Intervals between replies were unmanageable. R15 was responded to by R31 after 22 days but did not generate any interactive exchange of messages. Likewise, R33 that was given 24 days after the original posting did not draw any attention, hence an infertile contribution.

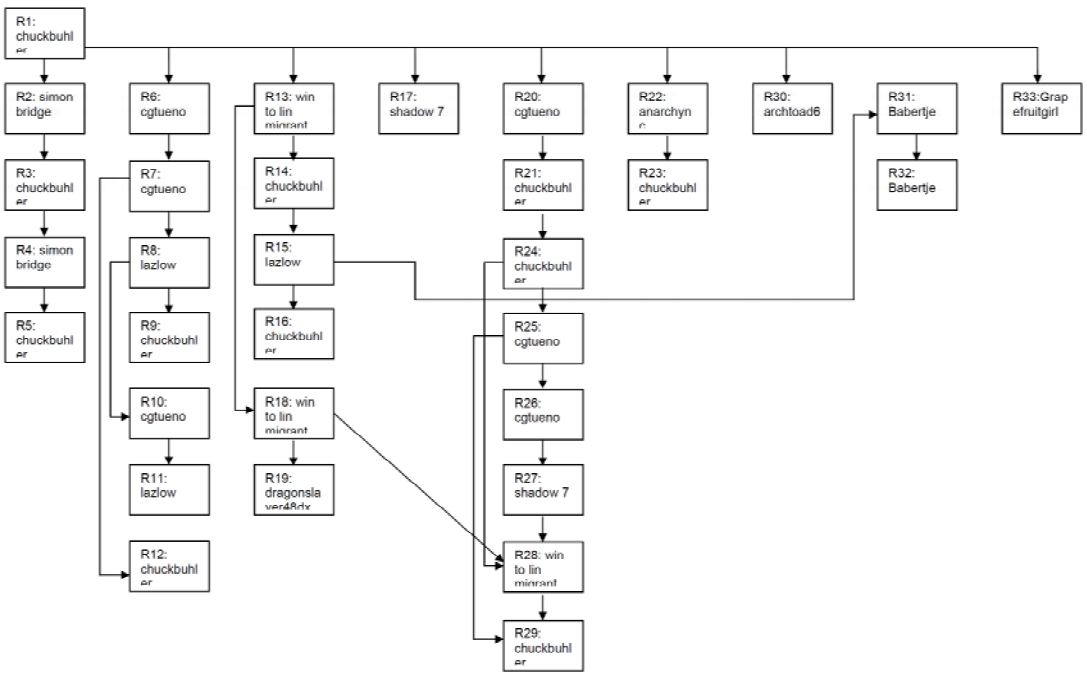


Figure 2. An Illustration of Fragmented Dialogue Flow

Since such temporal and sequential order does not have significant intentionality to

influence open collective inquiry processes in online forums, I focused on identifying types of dialogic actions each of which contributed to open collective inquiry processes in distinct ways. I identified 195 types of dialogic action in the context of open collective inquiry from open coding (Appendix A) and sorted them into six categories based on their purposes of action. I labeled these categories of dialogic action as "action domain" and considered them as constituents of open collective inquiry.

4.1.1. Six Types of Action Domain by Purposes of Dialogic Action

I identified six types of action domain ─ to initiate inquiry, to maintain commitment, to guide inquiry flow, to frame a problem, to negotiate solutions, and to confirm workability. I envision the open collective inquiry processes to be shaped by participants' move among and between action domains through their dialogic actions, rather than a sequential addition of individual contributions. Although the temporality was implicit in open collective inquiry processes, the way a dialogue unfolds was not necessarily sequential. Dialogue tends to move back and forth among and between action domains, and, in doing so, action domains of open collective inquiry processes become mature enough to generate working knowledge for problematic situations inquired about. I summarize characteristics of these six action domains of open collective inquiry in Table 7.

Table 7. Characteristics of Six Action Domains of Open Collective Inquiry		
Action domains	**Description**	**Purpose**
To initiate inquiry	Where problems and objectives are presented initially	demonstration, commitment
To maintain commitment	Where people determine whether to participate in the inquiry proposed	support, inquiry (dis) justification
To guide inquiry flow	Where people maintain inquiry flow coherently and avoid breakdowns and conflicts due to irrelevant contributions	quotation, coherence, flaming/de-flaming
To frame a problem	Where people exchange information about problems to build a shared understanding of problems inquired about	specification, consolidation, diagnosis
To negotiate solutions	Where people exchange hypothetical solutions and opinions about them	suggestion, validation
To confirm workability	Where people confirm the workability of solutions and reproduce them	experimentation, post-production

Action Domain to Initiate Inquiry

An original posting is viewed as an instrumental action domain that can transpire a discussion thread dedicated to open collective inquiry. In this action domain, an OCI initiator posts a message in which he initially informs others of his problematic situation and call for others' help. I identified 21 types of dialogic action from 80 original postings sampled. Two themes emerged — problem demonstration and conveyance of commitment (See Appendix A). OCI initiators who post an original posting to initiated a discussion thread needed to indicate their motivations for searching for working solutions by presenting objectives of inquiry and desired contributions. They also promised a sincere undertaking of others' future contributions and continued involvement throughout future courses of open collective inquiry processes.

Problem demonstration is the most essential element of this initiating action domain because other participants can know of problematic situations inquired about only

through OCI initiators' description. Ways OCI initiators demonstrated problems vary in terms of coverage and expression. OCI initiators provided information about various aspects of their own problematic situations, such as observation of symptom, specific context, initial problem diagnosis, problem severity, and general background, in varying extent. Also, OCI initiators delivered problem description in distinct formats; one can verbalize his observation and interpretation or can reproduce raw data of problems. 36 out of 80 original postings sampled for the present study included raw data, to substantiate their statements, such as code sets, attachment files, and snapshots. Eight original postings included direct links to resources as a starting point of an intended inquiry direction; or they provided them as references with which they made initial opinions on their problematic situations. In the quotation below, an OCI initiator provided a direct link to an external resource that she referred to install a printer driver. This became an importance to demonstrate what the OCI initiator did previously and a basis for others to diagnose problem causes and to provide suggestions.

> I am trying to install HPLIP 3.9.6b onto my MEPIS 8 system. I just bought a new HP Officejet j6480 All-In-One. I am using the following website as a guide: http://hplipopensource.com/hplip-web...ros/mepis.html. Look at Step 4. … Why am I getting that message and what can I do? I am stuck. (L17-#1) – Use of direct link

Adequate and precise problem description was instrumental to call for others' participation, but OCI initiators could also reassure others that problems inquired about were true and worthy of their participation. OCI initiators conveyed their concerns and promised their sincere undertaking of others' future contributions. One way to convey OCI initiators' commitment in this regard was justifying problems inquired about by presenting the evidence of prior problem solving. In the quotation below, an OCI

initiator struggled to make her system to detect a USB driver. She demonstrated what she had done to address her problem previously. Although such demonstration of prior efforts was not offered with outcome details that were requested later, it made easy for others to start with.

> It seems to me that none of my usb devices are being seen. I've tried dmesg and can't see any of them listed there. With lsusb -v I get no output at all. With lsusb -t I get: "cannot open /proc/bus/usb/devices. no such file or directory". (L16-#1) – Prior effort

In addition to problem demonstration and commitment, OCI initiators expressed friendly gestures using greeting, a priori appreciation, and light joke. They also conveyed a priori excuses for their inadequate expertise to resolve their problematic situations by themselves. Two quotations below are some examples of such friendly gesture. However, these indications of delimited expertise in this action domain were found mostly in unsuccessful inquiry outcomes and were more of the evidence of a knowledge gap rather than of a guarantee of gentle responses.

> I've never actually built one from scratch before, but I have a bit of experience with upgrading/changing/swapping components. (L9-#1) ─ *Delimited expertise*
>
> It's my first time posting on this forum, used a lot for entering in this new world of linux and now some help would be really appreciated. (L21-#1) ─ *Delimited expertise*

I observed a variation in the extent to which OCI initiators employed actions performed, contents of action, and *argumentative components* to illustrate problems. Below are three examples. Example A included a mixture of different types of dialogic action. It indicated a summary of a problem symptom inquired in its title, which demonstrated that the discussion thread was committed to the particular problem (1). Its body text included descriptions of the problem symptom and context based on an OCI initiator's

observation (2), (4). These statements performed *expositive* dialogic actions giving constructive response. By reporting failed outcomes of prior problem-identifying and problem-resolving efforts with direct transcription of error messages (5), (6), the OCI initiator performed *expositive* dialogic actions giving unsupportive response. At the same time, it indicated the OCI initiator's limited expertise and concern about the problem (3) and elicited others' help (7) as non-felicitous dialogic actions. These dialogic actions generated further interactions over 15 subsequent replies, including nine relies by the OCI initiator himself. Contents of problem description were further justified in two replies and specified in eight replies. Hypothetical solutions for the problem were suggested and validated in nine replies, and the workability of solutions was established in four replies.

> **Example A:** (L33-#1)
>
> Title: Seagate FreeAgent, NTFS, cannot mount volume (1)
> Ok. on one computer (mandria 2008.0) i plug in the drive (entire drive, 1 partition, NTFS), in kde/gnome, drive pops up, mounted as ntfs-3g. on every other mandriva 2008.0 install in my house, i have to manually mount it (mount -t ntfs-3g /dev/sda1 /media/hd). (2)
> I have a bunch of noobies at home, so its driving them and me nuts. (3)
> I don't know/remember what i did to this one computer to make it special, other than using it all the time. (4)
> kernel messages when plugging it into any other install:
> kernel: FAT: bogus number of reserved sectors
> kernel: VFS: can't find a valid FAT filesystem on dev sda1 (5)
> It would appear that i don't have ntfs support on the machine, but when i do mount -t ntfs /dev/sda1 /media/hd it works fine, kernel says kernel: NTFS volume version 3.1 i can read files just fine.(6)
> any ideas?(7)

In contrast, Example B focused on providing objective details of a problem inquired and refrained from arbitrary interpretations and personal gestures. Four dialogic actions were identified in this original posting. Its title indicated a specific error type. The other three described the problem inquired about, such as a code set causing error messages (2) and

the observations of symptom (3) and frequency (4). These contents about the problem were followed by 15 replies from nine participants for further specification. The OCI initiator provided additional problem details in another reply but remained silent afterwards. The thread was taken over by someone with a similar problem, and that person led the rest of open collective inquiry. The problem was further specified by eight replies, hypothetical solutions were suggested and tested in eight replies, and the thread constructed a working solution at the end.

> **Example B:** (A9-#1)
>
> Title: Error #1009 in/compute SelectionIndexInContainer()(1)
> TypeError: Error #1009: Cannot access a property or method of a null object reference.
> at flashx.textLayout.edit::SelectionManager$/computeSelectionIndexInContainer()
> at flashx.textLayout.edit::SelectionManager$/http://ns.adobe.com/textLayout/internal/2008::computeSelectionIndex()
> at flashx.textLayout.edit::SelectionManager/selectionPoint()
> at flashx.textLayout.edit::SelectionManager/setNewSelectionPoint()
> at flashx.textLayout.edit::SelectionManager/mouseDownHandler()
> at flashx.textLayout.container::ContainerControllerBase/processMouseDownEvent()
> at flashx.textLayout.container::ContainerControllerBase/http://ns.adobe.com/textLayout/internal/2008::mouseDownHandler()(2)
> Sometimes when i just drag mouse on tf container, it throws this exception. (3)
> Quite many times.(4)

Example C did not provide any practical information about a problem inquired. Its title vaguely defined a problem topic (1). The OCI initiator indicated her inquiry objective and knowledge desideratum (3). Nine participants responded to this original posting and contributed 19 replies. They requested problems details and suggested several problem diagnoses and hypothetical solutions. However, the OCI initiator poorly responded to such suggestions and was reluctant to provide any test outcomes. The discussion thread did not reach any agreement on a potential working solution.

Example C: (S8-#1)

Title: Managing attachments on ABAP Webdynpro launched from UWL(1)
Hi All, (2)
I want to attach some files on ABAP webdynpro and send the same to R/3 Workflow. I want again to get the same from Workflow container and show as link on ABAP Webdynpro. (3)
Thanks
Deb

In this way, dialogic actions that OCI initiators performed in the action domain to initiate inquiry not only demonstrate necessary information about problems and OCI initiators' commitment but also indicate the extent of OCI initiators' ownership of their inquiry and their prospective involvement. This seemed to become critical criteria for others to decide their participation.

Action Domain to Maintain Commitment

Elements presented in the action domain to initiate inquiry can leads to three distinct action domains — action domain to maintain commitment, action domain to frame a problem, and action domain to construct solution. In most cases, problems and requests for help demonstrated in original postings were not always clear and convincing to prospective participants: exactly what problems were inquired about and how valuable these problems were of others' efforts to help. These issues should be adequately addressed in order for prospective participants to build commitment and to make relevant contributions. One of them is an action domain to maintain commitment in which participants examine the truthfulness of problems inquired about to determine their supports for endeavor to solve the problems. Some participants questioned the practical value and the soundness of problems, whereas others conveyed support and commitment to open collective inquiry. In doing so, they constructed motivations and

commitment for expending efforts throughout the course of open collective inquiry. I identified two themes in this action domain to maintain commitment — inquiry justification and conveyance of support.

Inquiry justification refers to participants' arguments against or in favor of the truth and value of problems inquired about. Although OCI initiators posed their original postings on confronting seemingly obvious and critical problems, such initial motivation alone was not evident and adequate to convince potential participants to act for open collective inquiry. Other participants needed to confirm the value of inquiry that they were invoked to expend their resources such as time and efforts by contributing replies. Thus, attempts to disapprove the truthfulness of problems, called inquiry dis-justification, and approve it, called inquiry justification, were crucial dialogic actions in this action domain. Inquiry dis-justification denied the truthfulness of problems for various reasons, such as avoidable problems, general and natural outcome, misperception due to incorrect assumption and wrong choice, insignificance, irreparable condition, and unproblematic situation. In contrast, inquiry justification occurred based on prior unproblematic situation, prior efforts of problem solving, and problem severity and significance. The quotation below showed a dialogic action that disapproved of the validity of a problem in an original posting for an irrelevant use of the USB. The statement was reputed by the OCI initiator, saying that the problem inquired about was real because he had not had a similar issue in other situations. A balanced tension between inquiry dis-justification and inquiry justification was observed in the most constructive discussion thread.

> USB is not meant to be use for storage. It is meant to replace communication

> ports and PS/2 connections. USB cannot handle high speed data all the time because it is too software dependent… Everybody has this problem. It is just how USB works in any operating system. (L1-#2) ─ Inquiry dis-justification
>
> For over two years, it wasn't a problem for me until this past summer. That's across four versions of Ubuntu (Edgy, Feisty, Gutsy, and Hardy), Slax, Slackware, Backtrack, Debian, DreamLinux, and Mint. It certainly isn't a problem on any of the Vista or XP installs I have laying around, either. (L1-#3)- Inquiry justification

The conveyance of support, either affirmative or critical, was also crucial in that that could hold up other participants' engagement and improve a future course of inquiry. Participants including OCI initiators convey their affirmative support by promising sincere undertaking, demonstrating interest and goodwill, expecting constructive inquiry, showing empathy to others' emotion, and engaging in continued problem-solving effort. Such things keep transmitting participants' commitment to others to keep them within an ongoing open collective inquiry process. Participants also encourage ongoing open collective inquiry by acknowledging progress, merit of inquiry, and value of contribution as well as share discouragement and difficulty in problem solving. Two quotations below show examples of such supportive commitment. In the first quotation, an utterer conveyed her commitment to a contributor who suggested a solution by promising undertaking the suggested solution in near future. In the second quotation shows an utterer encouraged others by acknowledging the merit of open collective inquiry, as someone concerned about its steady progress.

> I will try to catch it again and report in details. (A9-#3) ─ *promise of undertaking*
>
> At this point, we are learning together!! (I hope that someone else will join us for the final push to an answer). It now appears that we know how to get from the **Canon** files to a .ppd file. (L15-#14) ─ *encouragement*

Another way to convey support in a critical way is to request conforming to proper

inquiry norms by pointing out what could impede others from making proper contribution. Participants lay norms to regulate open collective inquiry constructively; for instance, they tended to hesitate or decline to contribute when there were little evidence of adequate prior efforts and search and serious consideration of suggestions. They also criticized problematic manners and self-satisfying motivation. The first quotation advised abiding by a general norm to post a question. It also provided a long list of helpful links for search. However, this presupposition on inadequate prior effort annoyed an OCI initiator, as he claimed that he already went through most of the links but only did not mention in his original posting. The second quotation criticized an OCI initiator's problematic attitude crying for immediate response with ready-made solution. It advised him to maintain a constructive, self-helping demeanor while expecting others' help.

> Before I start on what I found about your problem, I'd like to make 2 suggestions about what to post:
> 1. Post links to mfr.'s h/w info. -- it will save prospective helpers time & thus make it easier (read more likely) to try to help.
> 2. You are expected to try to solve your problem yourself before you post, Google, Google Linux, & searching LQ are good ways to this. If you then posted your searches, your helpers would get up to speed on your problem (& therefore be more likely to try to help) much quicker, not to mention know that you did already try to figure it out on your own. (L4-#2) ─ *constructive inquiry norm*
>
> Easy on the posts for no reply posts for two reasons
> 1. None of us are paid and are all volunteers, most have full time jobs.
> 2. It took you off the Zero Reply Threads (L10-#4) ─ problematic attitude

The action domain to maintain commitment was by and large populated at the early stage of open collective inquiry followed by the action domain to initiate inquiry, but not limited to the period. Such commitments were maintained and renewed throughout open collective inquiry processes as new comers joined with unforeseen doubts about an

inquiry in progress and as new issues arose during the progress. In this way, this action domain becomes an important constituent that establishes the legitimacy of collective efforts to help others and keeps open collective inquiry coherent.

Action Domain to Guide Inquiry Flow

Discussion threads in online forums were almost self-regulatory, meaning participants controlled the order and coherence of their discussions without any explicit intervention of a moderator; I only observed only one case out of 80 threads analyzed in which a moderator shut down a discussion thread for severe flaming. Because the present study investigates open collective inquiry through dialogue, I focus more on dialogic actions that were directly associated with dialogue flow and inquiry progress than those that were implicated with personal and social gestures, such as greeting, name calling, and general appreciation. Dialogic actions that intended to organize the order and the coherence of discussion were viewed to form the action domain to guide inquiry flow. I identified three classes of purpose arose in this action domain — grounding, deflaming, and coherence.

Grounding is viewed as an alternative way of organizing turn-taking in online forums where the order of dialogue is unlikely to form a single linear sequence. Name-calling was a common way of designating a next order in online forums, but quotation was more preferred. As mentioned above in Figure 2, connections between and among replies were poorly structured and uneasy to follow. Thus, participants in online forums were more likely to quote whole or partial statements of prior replies to designate their statement more clearly. This could also relieve others' efforts to retain all prior

discussion or to search for designated part(s). Below is an example of partial quotation to designate an utterer's response. Sometimes, they included multiple quotations from multiple replies to respond them all in a single reply. This became an important converging point that put scattered opinions together toward a coherent dialogue development.

> Quote: Originally Posted by **ooo**
>
> Still a no go. I'm not exactly sure what you meant by "create a container for it" unless you assumed I had multiple devices plugged into the **controller**.
>
> We both have to remember, I have a TX4650 PCI-E card, and you have the same chip but integrated on your **motherboard**. (L4-#20)- Partial quotation to give clarification

Partial quotations were useful for making detailed responses, but almost sentence-by-sentence partial quotation made discussants exhausted and emotionally charged for being criticized for every detail. It is interesting to find that such prompting partial quotations often became a precursor of degraded open collective inquiry. For example, a discussion thread that inquired about resolving malfunctions of a motherboard was degraded momentarily due to harsh flaming. Here, two discussants also denounced each other's statements by quoting each other's statements sentence-by-sentence. At the end of their quarrel, one said, "*QFT*", the other mocked, "*huh, Quantum Field Theory*", and the first one refuted, "*Quoted for Truth*." Then, the second discussant left the thread in the middle of the discussion. In this way, quotation is an effective and unique way of grounding replies in online forums. However, it also became a device that could easily distract an original inquiry objective by making participants focused more on specific details to validate their arguments than on overall implications for solving a problem inquired about to help others.

Although altruistic participation and constructive contribution and were largely presumed in online forums in the context of collaborative learning, it was also common to observe irrelevant, poorly validated information, and non-value adding activities. There also existed flaming with which participants conveyed emotionally charged feeling and contributed to online forums self-satisfaction: some participants depreciated others' contributions, mocked their misunderstandings, and attempted to trounce others' opinions. Such malignant contributions could occur in any discussions, but not all ended up as degraded inquiry. Participants also sought to alleviate harmful effects of such contributions. I identified two ways to handle them. One is deflaming that refer to remarks that intend to alleviate emotional disturbance, such as apology, humor, and personal gesture. Participants intended to avoid flaming regarding the truth of their remarks by putting preemptive excuse for possible irrelevance and misinformation or acknowledging their limited expertise and openness to diverse opinions.

> I was bothered that the incorrect things you are saying would confuse other people reading this thread. I thought I should try to balance that. (L28-#13) ─ Flaming
>
> Don't take this the wrong way, but if you've had "bad experiences" with software RAID (presuming you are talking about mdadm) then you probably won't have better experiences with hardware RAID (L5-#6) ─ Deflaming (preemptive excuse)

The other is to actively manage coherence of open collective inquiry. Participants explicitly enumerated desired information and knowledge, prioritized an order of inquiry objectives, and organized dialogue moves by setting next inquiry objectives (See the first quotation below). They ruled out irrelevant and invalidated information to prevent further contributions associated with such non-value adding contributions (See the

second quotation below). Arguing over the relevance and validity of contributed statements, discussion threads could be easily distracted and could attribute flaming. Failure in such attempts caused its degraded outcome. When a open collective inquiry process was stuck or kept generating invalid outcomes, participants also sought for alternative directions or recessed open collective inquiry to control its pace. Such dialogic actions to maintain coherence could have been administered most effectively by its OCI initiator as the owner of discussion threads. For example, the extent to which an OCI initiator attended to his discussion thread in this action domain was a crucial requirement for successful open collective inquiry.

> The next step is to get a SATA DVDRW and just bypass the issue. Not real high on my priority list, but someday. These IDE drives would work well in an external USB enclosure or possibly a good upgrade for the CDRom in my oldest grandson's computer (L8-#16) ─ Direction for next step
>
> As I explained in post 28, we can't change anything that will affect apps already in the wild without a version check, and we don't get a version check for the 10.1 dot release. (A20-#35) ─ Declination of irrelevant contribution

Participants could benefit from dialogues in online forums by exchanging diverse opinions from people with distinct background and expertise. However, decentralized dialogue process deprived of coherent control made online inquiry vulnerable to unfavorable, self-satisfying contributions. In this action domain to manage dialogue and inquiry flow, participants intended to overcome such unfavorable effects by consciously guideing dialogue and inquiry flow; they strained out irrelevant and invalidated information and incorporated independently made suggestions into a constructive direction. Also, participants effectively managed seemingly unorganized dialogue flows due to uncontrolled and asynchronous participations as they could make more precise points of turn-taking using quotations.

Action Domain to Frame a Problem

Initial problem description provided in the action domain to initiate inquiry is mostly insufficient for others who cannot "see" it to understand problematic situations correctly and to make relevant suggestions. Participants thus need additional information of the problem inquired about. I categorized such dialogic actions that intend to gain more information to frame a problem inquired about into *an action domain to frame a problem*. In this action domain, participants garnered scattered descriptions of similar problem symptoms and assimilated them into a shared image of problem. Precise problem framing was also needed to ensure prospective participants' involvement in open collective inquiry and helped them make relevant suggestions for problem solving. I identified three kinds of dialogic action in this domain: problem specification, problem consolidation, and problem diagnosis.

I classified dialogic actions that attempted to garner more information of a problem inquired about into specification. Requesting problem details and providing requested details were two complimentary types of dialogic action. Such actions were common in most open collective inquiry dialogues studied in the present study. Participants asked problem-specifying/clarifying questions to resolve uncertainty and ambiguity. They also requested OCI initiators to conduct basic check-ups and to provide such outcomes, if any. It was important for OCI initiators to address such requests adequately and promptly. The first quotation below is an example of requested additional problem information to resolve his unsatisfactory understanding of a problem inquired about. The second dialogic action quoted below conveyed a more *directive* tone by requesting the hearer to

do things that could generate desired information. OCI initiators or participants with similar problems responded such requests by providing requested details in similar ways like the third quotation below. They also supplied additional unrequested information that they thought be useful for others.

> Can you provide more specific steps to reproduce this? Maybe a code snippet that allows us to recreate the error? How are you using TLF? Flash CS4? Flex? Did you obtain TLF from the labs site, or from the Gumbo repository? (A9-#2) ─ Request for problem specifying details
>
> Things to check:
> 1. Are the permissions on the ppd file correct?
> 2. Are you using USB-2? HP laser printers will not **work** with USB-1, so it is conceivable this could be an issue with **Canon**.
> 3. CUPS logs. (I've never looked at them, so I'm only guessing that they exist somewhere.) (L16-#14) ─ Request for basic checkup
>
> Sorry about that, here go all the needed source files
>
> Attachments: ftl_gifplayer_example.zip (23.9 K) (A18-#22) ─ Requested problem detail

It was a critical norm for any open collective inquiry effort to supply others requested problem details adequately and promptly. Failing such responsibility led open collective inquiry dialogue ineffective or degraded other participants could get confused about what to contribute and because poorly responding OCI initiators failed to assure the value of problem inquired about. For example, in one degraded dialogue, an OCI initiator gave a short problem description in an initial posting. Several participants attempted to help him by asking more about the problem inquired about. However, the OCI initiator poorly responded such requests but only whined for a working solution. One participant asked about a size of persistent file that he thought was basic to understand the OCI initiator's problem. However, the OCI initiator only provided information that he could derive without expending additional effort and did not provide precise information requested. That became a clear indication of the OCI initiator's

careless attitude and lacking motivation, although the OCI initiator lacked knowledge to understand what was requested in part. The person who kept asking additional information to help the OCI initiator eventually got disappointed and left the discussion thread (See below quotations).

> You said you had followed the same link I posted when you created your Mint Live USB install.. part of those direction were about creating the persistent file.. now you say you don't know what a persistent file is ???
>
> Very difficult to help you if you are not clear on what you did or did not do (L10-#12)
>
> Have you bothered to actually read (not skim) any of the links that have been posted ? the persistent file is called casper-rw (L10-#28)

Problem consolidation refers to dialogic actions through which participants (other than an OCI initiator) intend to share similar problematic situation. Such dialogic actions not only confirmed that a problem inquired about was not a single peculiar case but a common case that necessitated open collective inquiry to resolve the problematic situation. In describing individual cases, participants also exchanged additional problem-specifying information observed in distinct and clues for problem diagnosis. Diverse ways of consolidating problem were observed; some simply confirmed problem occurrence and solicited solutions. Some described their individual cases in details and even conjectured problem causes to suggest solutions. The quotations below exemplify such problem-consolidating dialogic actions. The first quotation not only confirmed a problem inquired about but also shared the utterer's experience of prior efforts to figuring out the situation. The second quotation posed a similar problem to assure the problem occurrence and called for help. The third quotation was emotionally charged, emphasizing how the problem caused severe inconvenience. The last two quotations thus gave contents of action that challenged unresolved problematic situations.

> Does anybody have a solution to this issue? I'm facing the same thing, and I can tell that it's not a power issue. I also used more than one kernel version. Stripped a lot of things out of it... (L3-#31) ─ Problem consolidation
>
> bumpity bump, same issue - nobody has a solution, haven't heard anything back from anyone from adobe. time is money, and I wasted a lot of time on this..a lot. (A19-#2) ─ Problem consolidation

Problem diagnosis refers to those dialogic actions that assessed possible problem causes based on given problem-specifying information. This included varying elements of problem diagnosis, such as reasoning process, ground, and verdict for solution, which was important to make hypothetical solutions more plausible. I observed varying levels in such dialogic actions; utterers provided assertive problem diagnosis, moderate conjecture, experiment-based diagnosis, narrowing-down of problem causes, or indication of confusion. The first quotation below showed a dialogic action that made an assertive diagnosis based on a prior description of problem symptoms did not explain any causal relationship. To the contrary, the second quotation assimilated descriptions of problem symptoms made from previous experimentations and established a moderate reasoning of causal relationship.

> Your card is damaged physically. The symptoms make that absolutely clear. (L6-#29) ─ Assertive diagnosis
>
> Here's a thought: From your description (problem after installing XFX) it might be that the XFX is requesting a large memory segment from your BIOS, and the BIOS is not doing it properly so your video memory is being "shared" with the memory that the Linux initial RAM disk "thinks" is free. So the USB DVD buffer and the video buffer are trying to use the same block of memory, which would, of course, really make it hard for the DVD to be read correctly. (Memory allocation and usage in Windows is done differently for the way it's done in Linux systems, so the allocation problem - if that's what it is - may not be so apparent with your Windows systems.) (L24-#12) ─ Diagnosis based on experimental interpretation

The three types of dialogic actions were predominating in the action domain to frame a problem. These dialogic actions primarily intended to exchange objective problem

description and to supply others with opportunities to investigate problems. This action domain is closely interrelated with an action domain to negotiate solutions, as precise problem framing becomes essential to make relevant suggestions to derive working solution properly.

Action Domain to Negotiate Solutions

Although participants' contributing hypothetical solutions and opinions were crucial in online forums, not all contributions were acknowledged and taken into account right away. Rather, contributed solutions and opinions were most likely to be validated by others and to compete over plausibility against alternative opinions. Thus, suggesting hypothetical solutions and opinions and validating them were two types of action that are needed to negotiate solutions. Such dialogic actions that intended to achieve the two purposes were sorted into an action domain to negotiate solutions.

When an utterer contributed his expertise for the sake of helping others, it was already implicit that she expected the hearer to follow what she suggested to do. Some participants simply provided hypothetical solutions that they believed should solve a problem inquired about in an assertive and *directive* manner. However, a majority of participants sought to add better plausibility to their suggestions using various elements, such as direct link to references, expected outcomes, personal experience and practice, and general knowledge and explained how such things were reasonably related to problems inquired about. In the first quotation below, an utterer suggested a hypothetical solution with which he achieved an adequate success. She also provided an output code set as an expected outcome — what the hearer would see as a result — to ensure the

plausibility of the suggested solution to the hearer. In the second quotation below an utterer acknowledged the merit of an OCI initiator's effort, and added demonstrates that an utterer suggested an alternative solution and added specific details to other's prior suggestion.

> Try "apt-cache search hplip". When I run this in my computer, I get the following:
>
> code: (deleted)
>
> If you determine that Mepis has a package for it, I would suggest you simply install that ("apt-get install hplip", or use synaptic), and stop mucking around with this source stuff (L17-#18) ─ Suggestion of hypothetical solution with an expected outcome
>
> You are on the right track but you don't even need to fill something in the event container. Just create a container element in your workflow container as advised by Arghadip, but choose a multiple value data element (i.e. one letter per even as you suggested) instead of a bollean. You can then fill that container element in the event->workflow binding by hardcoding the letter. (S17-#7) ─ Suggestion of hypothetical solution with an expected outcome

However, suggested solutions were likely unclear or disagreeable at first. Hearers attempted to resolve such infelicitous conditions by requesting further explanations or by contesting over the validity of what was suggested. Just as interactions over problem justification, participants exchanged requests for further explanations and responses with additional explanations requested. To make one's contribution of hypothetical solutions meaningful and useful, contributing participants needed to provide additional information in response to such requests. They clarified the hearer's confusion and also followed up their suggestions with preemptive and additional information that might be helpful for the hearer to execute the solutions. In doing so, participants jointly developed a hypothetical solution in a more concrete and testable form. For example, in the third quotation below, a hearer demonstrated his confusion about a hypothetical solution suggested and requested further explanation to resolve the incomplete understanding.

> Can you please tell me what no of lines you have written in _Hindi.swf file so that I can try this with my CSS file. (A10-#29) ─ Request for explanation

Suggested hypothetical solutions were often questioned for their validity and relevance. In a passive form of such validation, hearers assessed the relevance and worthiness of hypothetical solutions to determine their acceptance of the hypothetical solutions. When they felt such hypothetical solutions lacking relevance and validity, they declined them. Such declination occurred when hearers could not afford or able to follow suggestions, already tried them but found ineffective, or did not prefer to suggested solutions. Some hearers behaved more cautiously and deferred their acceptance or declination until they could confirm the reliability of suggestions. The first quotation below is an example of such declination of suggested solution. An utterer declined what was suggested because she already considered it but did not match her preference. The second quotation below exemplified deferred acceptance. An utterer expressed her doubt about a particular point of what was suggested.

> We've been considering the possibility of using something like Base-64 encoding to embed smaller images into the markup. We were probably going to use the JPEG or PNG encoder that's built into the Flex framework to compress the bitmap data before going to a character-based encoding that could go into the XML. (A18-#7) ─ Declination due to non-novelty

> The one part I wasn't sure of was how the cost would work out in the end, because I haven't taken the time to compare the different situations. If it's generally agreed upon that you can save a significant amount by building your own, maybe I'll just go that route. ─ Deferred acceptance

A more active form of validation was to support or to contradict suggested solution with reasons and grounds. While the passive validation, i.e., declination, was mostly carried out by OCI initiators, this active validation was not constraint to OCI initiators. In most cases of open collective inquiry, a problem inquired about received suggestions of

multiple hypothetical solutions. Participants competed over better plausibility and validity by contesting other's statements or by securing similar approaches. When they agreed with prior suggestions, they confirmed the validity of the solutions and added further information and evidences to better convince the hearer. See the first two quotations below. The first quotation below simply confirmed the validity of a prior statement, whereas the second quotation corroborated a prior statement to correct an original posting's unclear conception of the problem and added supportive evidences to the prior statement.

> This is true for the version of Arial that ships with Vista. The XP version of Arial has the non-zero-width diacritic problem, unfortunately. (A17-#20) ─ Support for prior suggestion

> ROLE? or RULE? One cannot directly send the workitem to a user who is having a set of roles, First define the respective logic to determine the users which are having set of roles to whom the workitem needs to be sent, then create a RULE from PFAC txn and in that select the rule as **Function to be executed** and mention the function module name and now in the dialog task select RULE and do the needed bindings from task to rule and get the agents.(S9-#3) ─ Support for prior suggestion and extension

When participants disagreed with others' suggestions, they declined or contradicted the suggestions with counter-evidence. Not a few cases, participants tended to be evaluative about others' lacking validity, even fault-finding, rather than to overcome it collectively. Such remarks did not add much to open collective inquiry. I distinguished constructive contradiction from such deconstructive one — denouncement, although both intended to rebut other statements. Dialogic actions for constructive contradiction intended to correct others' misunderstanding and wrong assumption, while open to taking the opposite perspectives into account. Thus, utterers performing such dialogic actions demonstrated contradictory ground and reasoning and were willing to extend their

dialogue over issues in disagreement. To the contrary, dialogic actions for denouncement tended to assert the invalidity and irrelevance of suggested solutions and to refuse any further contribution. The two quotations below exemplified the two different types of contradiction. The first quotation contradicted a prior statement that criticized lack of decent HTML/CSS support in combination with the TLF and urged a solution to address the inconvenience, showing that how the criticism was caused by wrong assumption on TLF. The second quotation showed a strong rejection of a prior statement attempted to publicize an utterer's arbitrary acronym of RAID (Really Array Inexpensive Disk) in place of general use of RAID (Redundant Array of Independent Disk) by criticizing its lacking general assumption and irrelevance.

> Standards-based text display is a misnomer. If you want the full spec and want to be able to do what HTML/CSS can do in Flash, then that's likely a Flash Player team issue and not a TLF issue. TLF is an actionscript library and it is not likely there will be parity between HTML/CSS within TLF for a long time. It's not a performant way of doing things. If you want HTML text and CSS support in AS3 project comparable performance and support, then Adobe will need to, literally, build in an HTML/ CSS engine into the Flash Player. Actionscript is not an appropriate place to do that. (A12-#11) ─ Contradiction for wrong assumption
>
> How can you say the setup is "costly"? This whole forum is based around Linux and the software RAID system built into this OS easily makes it the cheapest and most powerful basis for a RAID system if you are happy with software RAID. (L5-#13) ─ Denouncement for irrelevance

In this action domain to negotiate solutions, participants exerted their expertise to generate hypothetical solutions to suggest and to validate suggested solutions. Through the closer investigation of what was told to be effective, participants excluded irrelevance and added insights to construct an agreeable solution. Here, how to disclose ground and reasoning that utterers used for deriving hypothetical solutions and contradictory or supportive validation to hearers was crucial. It not only helped hearers

understand suggestions but also became provided a convenient basis for building next statements.

Action Domain to Confirm Workability

I classified dialogic actions that intended to test and to confirm the validity of hypothetical solutions suggested in the action domain to negotiate solutions through actual experimentations as the action domain to confirm workability. I identified two distinct purposes in this action domain: experimentation and post-production. Experimentation refers to dialogic actions through which participants intended to demonstrate outcomes of their actual testing of suggested hypothetical solutions. Some simply indicated a success or failure, but others provided detailed outcomes by explaining procedures of experimentation, outcomes, and their thoughts on such results. Because these outcome details were important sources on which participants re-framed a problem and revised hypothetical solutions, providing such information adequately and voluntarily was crucial for successful open collective inquiry. In the quotation below, an OCI initiator inquired about a limited workability of his webcam after testing several suggestions that he obtained. This detailed demonstration of the outcomes naturally led to his additional endeavor to overcome limited solutions. He asked for explanations to understand the unresolved problematic situation. He also shared additional information of what he found useful during his experimentation.

> but I've still no proper access to the webcam when logged in as a user.
> If I do:
> [user@localhost ~]$ groups
> I get
> user
> if I do
> [user@localhost ~]$ ls -l /dev/video*
> I get

> lrwxrwxrwx 1 root root 6 2009-02-20 19:27 /dev/video -> video0
> crw-rw---- 1 root root 81, 0 2009-02-20 19:27 /dev/video0
> [user@localhost ~]$ – Report of ineffective outcome
> so what does this mean? how do I get permanent access to the webcam when logged in as a user? – Request for explanation on ineffective outcome
> one thing i did try in root was right click on the video0 file in the /dev folder and chose properties/permissions tab. The group permission was set as root and I changed the group permission to user, then logged out of root, logged in as user and that enabled me to use the webcam, but that only worked until I did a reboot. On reboot of the machine all the permissions of the video0 file were back to root. – Report of individual inquiry (L19-#8)

When experimentation of a hypothetical solution obtained pleasing success, the solution became recognized as a working solution, and open collective inquiry could become settled. At this point, OCI initiators could leave her discussion thread only by indicating a closure, but some provided a summary and explanation of how a working solution was derived and made it working knowledge readily available for others' future use. Some also attempted to acquire full understandings of how suggested solutions worked rather than simply satisfied with unproblematic situations obtained. Dialogic actions that intended to do such purposes were classified into post-production. The two quotations below exemplified such purposes of post-production of working solution. In the first quotation, an OCI initiator solved his problem in installing a driver and summarized how he solved the problem step-by-step for others. In the second quotation, an OCI initiator attempted to stop his system's periodic rebooting. Although his system stopped rebooting at a certain point while trying several suggested solutions, he could not understand how it worked and considered the unproblematic situation only temporary and incomplete. He thus kept monitoring the situation and continued his inquiry until he obtained a reasonable sense making of a working solution.

> ok i think i have my **nvidia** installed..
> just fyi again for other ppl running into problems, i basically
> 1. re-ran the installation procedure as outlined from the F10 **nvidia** install guide,

comes up with nothing to do cuz its all installed
2. I renamed /etc/X11/xorg.conf to something else so that file doesnt 'exist' anymore.
3. **in** the terminal as root, go into init 3
4. type 'nvidia-xconfig' once **in** init 3
5. type 'init 5' to restart x
6. done! (L39-#12) – Summary of working solution

A report: this morning all seemed well. There were no **reboots**. So I reset the system clock in Gnome and then rebooted and reset the clock in bios. In other words, the experiment gave inconclusive results. (Remember, last time I had this problem was about 4 months ago, and then a week ago.) (L3-#19) – limited workability and poor sense making

In open collective inquiry, an OCI initiator was not the only person who held a problem inquired about. There could be other participants who had similar with the problem inquired about. Some participated in an open collective inquiry by actively sharing their individual cases to consolidate the problem. There was also silent audience who monitored discussion threads until the threads derived a working solution. Thus, in this action domain to confirm workability, an OCI initiator was not the only primary actor to perform testing and post-production. It was also common that a working solution that worked for an OCI initiator was ineffective for others who had similar problems. In such cases, participants attempted to extend the workability of derived solutions. For example, the quotation below, an utterer participated in a discussion thread that was dedicated to solve problems in installing printer driver. While an OCI initiator and some others solved the problem, he could not solve his one.

As I reported above, everything is fine on my 32-bit box. On Slackware64-current I have a couple of problems left to solve, and I would appreciate if someone could provide a hint.

1. Scanning with Skanlite always scans about 1cm too much of the page bottom. An ugly lower border in the copy is the consequence. Is this a bug (a) of the printer or (b) of the user or (c) of our own software.
2. I can't seem to get the PC Fax functionality working, yet, on 64 bit. Brother describes pre-requisites for a successful install on various distributions their web pages, just not for Slackware. EDIT: No such problem with XSane, but

> I prefer using KDE apps in KDE...I am stuck. (L20-#15) – limited workability

To recap, I identified six action domains that consisted of open collective inquiry processes and characterized them based on distinct purposes of dialogic action (See Table 7). I illustrate how these action domains are related to one another to generate a working solution for a problem inquired about in Figure 3. Problems inquired about in the action domain to initiate inquiry were further specified in the action domain to frame a problem and justified for their legitimacy for collective effort in the action domain to maintain commitment. These problems were also received various suggestions of hypothetical solutions. Suggested solutions were validated for better plausibility and tested for workability until participants reached a satisfying working knowledge. These dialogic actions were guideed throughout open collective inquiry process to maintain coherent inquiry flow. Next, I will illustrate how dialogic actions in each action domain constituted open collective inquiry processes and generate distinct outcomes in detail using four discussion threads.

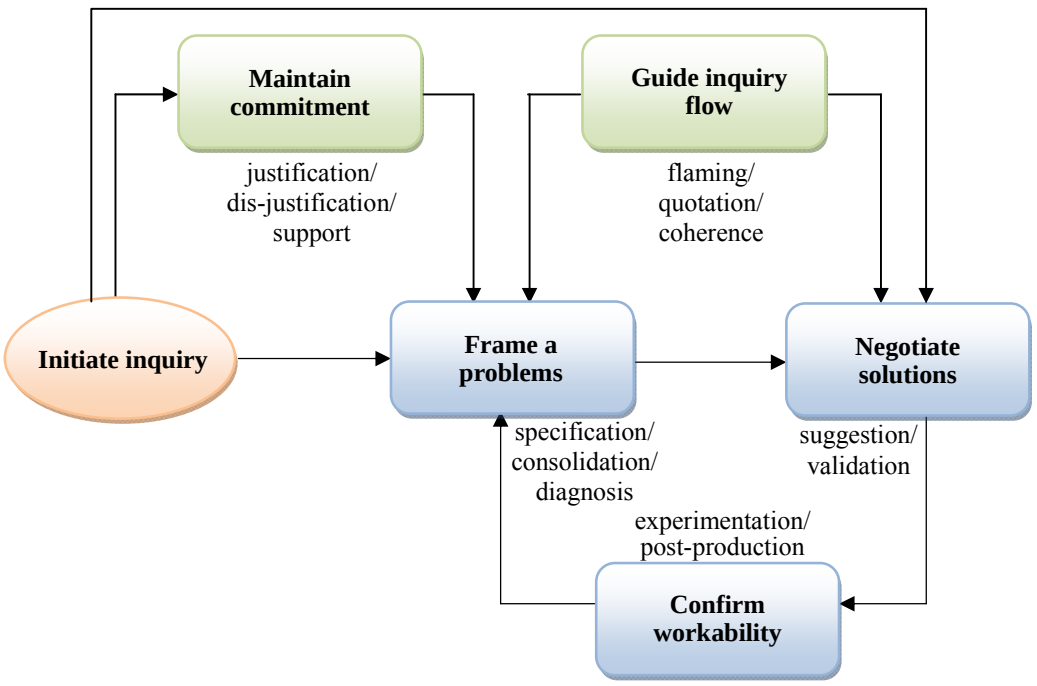


Figure 3. A Dynamic Process of Open Collective Inquiry

4.1.2. Four Illustrative Cases of Open Collective Inquiry

I chose four discussion threads each of which represented distinct types of closures: full closure, partial closure, non-closure, and degraded closure. Their descriptives were presented in Table 8. Thread 1 is one of 26 fully closed discussion threads in which an OCI initiator attained working knowledge with adequate understanding of it. This thread had 37 replies contributed by 10 participants including an OCI initiator, and 17 out of 37 came from the OCI initiator. The OCI initiator explicitly indicated that he attained satisfactory knowledge for his problematic situation toward the end. Thread 2 was chosen from 19 partially closed discussion threads that derived a working knowledge only with limited understanding of it. In the thread, three participants contributed 14

replies, and 11 out of them came from its OCI initiator. The OCI initiator found a working solution for his problematic situation but did not have an adequate understanding of the solution. He raised the issue, but the thread no longer continued. Thread 3 represents 30 discussion threads whose closures were unclear; they received several constructive suggestions and helps, but there were no indication regarding how such things helped. The thread was held by nine participants and received 20 replies. An OCI initiator attended the discussion thread making seven additional replies, but her contribution did not complement with others' requests. Although there were several suggestions and attempts to help, it was not clear whether the OCI initiator attained an adequate working solution. Thread 4 is one of five degraded discussion threads that suffered from flaming and did not reach any closure. Nine participants exchanged 18 replies, but unfortunately, an OCI initiator left the thread because self-motivated contributors argued each other without making constructive contributions to help his problem. The full text is available in Appendix E.

Table 8. Four Discussion Threads Exemplified

	Thread 1	**Thread 2**	**Thread 3**	**Thread 4**
Forum	Forum A	Forum B	Forum C	Forum A
N of Participants	10	3	9	9
N of Replies	37	14	24	18
OP's Replies	17	8	19	2
Closure Type	Full closure	Partial closure	Non-closure	Degraded closure

Thread 1. Open Collective Inquiry with Full Closure

In this discussion thread, an OCI initiator had a picture card damaged during picture file transfer. He provided a well-structured demonstration of his problematic situation, compared with the other three discussion threads. His original posting provided the OCI initiator's observation of problem symptom and description with raw error messages that

allowed others to make uninterrupted interpretation of the situation. At the end of the original posting, the OCI initiator clarified his desired knowledge by posing two explicit questions, so that potential participants could offer direct suggestions without expending efforts to read the problem description thoroughly and to reconstruct what exactly the OCI initiator inquired about (See Appendix E).

In the action domain to initiate inquiry, the OCI initiator claimed his problem as a "big problem." Such elicitation was often backfired in maintaining commitment by those who did not see equivalent significance, but the OCI initiator of Thread 1 supported this quite subjective claim with his prior problem solving efforts. The OCI initiator reassured the truthfulness of the problematic situation by contrasting prior unproblematic situation and providing his prior problem-solving effort and ineffective outcome in detail. Such detailed presentation of prior problem-solving attempts not only provided additional information of the problem inquired but also proved the OCI initiator's commitment to the problem. Indeed, the OCI initiator was actively managing his inquiry throughout the open collective inquiry process. In that way, the original posting justified the trustful existence of the problem adequately. However, one participant attempted to dis-justify the inquiry arguing that the problem was natural and irreparable. The OCI initiator, however, addressed such dis-justification by conveying his commitment and getting involved in his inquiry consistently. On receiving any suggestions, he promised to sincere undertaking, returned with outcomes and findings of actual experimentations on his side, and organized the process in a convergent manner. The OCI initiator took the discouraging participant's criticism regarding redundant and heavy problem depiction

positively. As a result of the OCI initiator's sincere commitment and conscious dialogic actions, he derived a satisfactory working solution. The discouraging and skeptic participant complimented his endeavor and achievement eventually.

> My picture card was good before I removed it from my camera and something wrong happened when I attached it to my machine and tried to mount it in my new system. Now it's useless. (Thread 1-#1) – Inquiry justification: problem occurrence
>
> For w1k0;
> It's better not to post so much stuff when describing a problem---people can get lost. – Inquiry norm: advice for constructive inquiry
> Also, flash memory does go bad. If I did not read anything else here, the part about dd not reading the whole card is suspicious. dd does not care about file systems or anything else--it just reads raw data.(Thread 1-#9) – Inquiry dis-justification: natural problem and wrong assumption
>
> I will try to trim down my eloquence in the future. I'm so garrulous, because I try to depict the problem entirely, and in the result I become boring. – Inquiry norm: concession to criticism
> I don't understand. If you cannot re-format the card (in your computer or in the camera) just discard it. There's nothing to repair. (Thread 1-#11) – Inquiry dis-justification: irreparable condition
>
> I am totally impressed how you stuck with this. Do you realize the percentage that give up at the first roadblock? So we can all sleep better (Thread 1-#25) – Encouragement: acknowledgement of progress

With the detailed, well-structured problem description in the action domain to initiate inquiry, participants in this discussion thread did not expend much effort to garner problem-specifying information. Probably, this was because the OCI initiator voluntarily provided as much additional problem-specifying information as possible. Thus, much of problem-framing effort was expended for diagnosing problem causes. Although the skeptic participant advised the OCI initiator not to supply too much information (see the first quotation and the second below), detailed, even redundant, problem information was obviously useful and crucial for others to provide constructive contribution.

> It's better not to post so much stuff when describing a problem---people can get lost. (Thread 1-#9)

> I will try to trim down my eloquence in the future. I'm so garrulous, because I try to depict the problem entirely, and in the result I become boring. (Thread 1-#10)

The OCI initiator started receiving hypothetical solutions from the first reply; that is, entering the action domain to negotiate solutions. For example, one participant diagnosed the problem caused by "yanking the card," but other participant denounced the suggestion due to its rare probability. The first person conceded to the denouncement for his irrelevant assumption in suggesting his solution, so the discussion thread moved forward.

> Quote: Yanking the card out without using a safe unmounting procedure can corrupt the filesystem.
>
> This only really counts if data was written to the card while he had it in Linux. The commands he ran shouldn't ever write to the card. (Thread 1-#5) – Denouncement for irrelevance
>
> His express question was "Can Linux damage a card", so I mentioned a way in which data can indeed get corrupted. You're right though in that it doesn't necessarily apply to this situation. (Thread 1-#6)- Correction of own misunderstanding

The OCI initiator tested all hypothetical solutions received from multiple replies and shared such detailed outcome in a single reply periodically (e.g., #7, #10, and #30). With this converging point he managed dispersed opinions and suggestions coherently; this effectively demonstrated what had been done and how such attempts turned out and was effective to prevent duplicated, redundant suggestions. For example, the OCI initiator of Thread 1 used name-calling to respond multiple suggestions in his every single reply that became a converging point of dispersed suggestions. Besides, he responded others' suggestions one by one, and furthermore, he updated his own inquiry progresses and detailed outcomes various times. He also updated a single reply several times as he

carried out experimentation of a suggested hypothetical solution. He also indicated his return to keep participants attentive to the open collective inquiry using such phrases like “To be continued” and expressed his thanks toward all contributions each time.

The OCI initiator obtained a working solution. Although he could confirm the workability of the solution and demonstrated how the successful outcome was achieved but could not understand how it worked. Thus, he continued the seemingly successful inquiry to improve its workability—to recover more image files and to find a problem cause.

> It's real miracle! I used the same command but the result isn't the same: myoutfileimage was full of FFs with small parties of garbage -- mytwinoutfileimage looks like the image of the device.
>
> I do almost nothing between myoutfileimage and mytwinoutfileimage. In fact I do something. I used card reader with my new xD card. I can't find any other explanation of that miracle. (Thread 1-#21)-Report of adequate success and limited sensemaking

Unfortunately, he could not recover all images as he aimed to, but he settled with a problem cause, physical damage to the picture card, and became satisfied with the ratio of picture recovery. As he noted, he tried as many problem diagnoses and hypothetical solutions in a demonstrative manner in this discussion thread. He clearly specified the topic and the purpose of the discussion thread both in the original posting and the last reply to help others re-use the thread for their problems relevantly.

> All the hints are valuable. Thanks to them. I tried stubbornly to gain the image of that device and I finally succeeded. I recovered 84% of the pictures. Different tips described in that thread can be useful for other guys in the future. (Thread 1-#34) – Acknowledgment of success and the value of inquiry

Thread 1 demonstrated a rich development of each action domain in open collective

inquiry. The OCI initiator exercised his ownership of the discussion thread and managed the open collective inquiry diligently. The OCI initiator generated and shared most of problem-specifying information while he carried out experimentations of hypothetical solutions received and updated his own inquiry progresses. Through the open collective inquiry process, the OCI initiator obtained a satisfying outcome and shared his entire inquiry progress for others.

Thread 2. Open Collective Inquiry with Partial Closure

An original posting of Thread 2 was terser than Thread 1, offering a specific problem context and associated error message. The OCI initiator acknowledged that he could avoid the problem by ignoring the error but was aware of an obvious limitation of the ad hoc solution. As such the dialogic actions in the action domain to initiate inquiry were neither diverse nor comprehensive.

The initial problem description was inadequate for others to understand the problem inquired about correctly and necessitated further information and explanation. For example, a participant in the reply #2 attempted to reproduce the problem inquired about in her system to assess it. The participant requested additional problem-specifying information (#2 and #5). The OCI initiator not only supplied requested information but also provided additional information that might be helpful voluntarily. Through the effort to garner problem specifying information, the participant got some idea of problem diagnosis and proposed a hypothetical solution. The OCI initiator tested the solution and reported that it achieved an adequate success in #10.

> Could you give us some more information?
> I haven't been able to reproduce that error.

> I'm assuming you're using TLF 2.0 (because of the callTheComposer call in the stack). What kind of changes are you making before you call updateAllControllers? (Thread 2-#2)
> What formatting are you applying to the ContainerController? (Thread 2-#5)-*Request for problem-specifying information*

However, the OCI initiator also found an unexpected issue in the solution. The participant acknowledged the limitation readily and got ready to be involved in the new issue because both expected it to be crucial information for updating the script. The OCI initiator provided problem description as invited. However, another participant intervened and raised alternative problem cause and suggested a hypothetical solution. The solution worked for the new problem. The OCI initiator had remaining doubt about the issue and the solution, but he had not known problem at the moment and stopped his inquiry.

> p.s. I discovered another little strange thing about updateAllControllers, which is of no concern to my program, but are you interested to know? (Thread 2-#10)-*Inquiry flow-introduction of new issue*
>
> We're working on getting our SourceForge updates automated. For now it's an ad-hoc manual process. I am interested in whatever you've found about updateAllControllers - please post details. (Thread 2-#11)- Acknowledgement of *limitation and engagement*
>
> I think you are right. When I set the ScrollPolicies off, the problem is gone. Still... isn't it strange that it is scrolling? (Like I said, it is of no concern to my program, just reporting this, so don't spent anymore time on this problem if you don't feel like it...) (Thread 2-#14) – *Attempt to extend sense making*

Two focal participants, the OCI initiator and a participant, maintained Thread 2. They kept close interaction throughout various action domains to frame a problem, to negotiate solutions, and to confirm workability. Thus, Thread 2 demonstrated a linear development and did not need many dialogic actions to maintain commitment and to manage inquiry process. On solving the problem inquired about initially, the OCI initiator identified a new issue and wanted to continue his inquiry. However, obtaining

an unproblematic situation became an ultimate goal to the participants, and the open collective inquiry was partially closed with an remaining issue.

Thread 3. Open Collective Inquiry with Non-closure

Unlike Thread 1 and Thread 2, Thread 3 did not provide concrete evidence of a problem inquired about in its original posting. An OCI initiator indicated his inquiry objective in a specific context. He indicated that he tried a solution but did not explain why he chose the solution and what an outcome was. This vague and inadequate problem description in the action domain to initiate inquiry did not properly trigger an open collective inquiry. It made a participant think that the OCI initiator did not conduct relevant basic checkup. As such, the OCI initiator received several requests for basic checkup from other participants in the reply #2, #6, #8, #12, #15, and #20. The OCI initiator responded to those requests saying that he already did the basic checkups with no success. However, he did not supply others with any detailed outcomes that those who requested the basic checkups wanted to see. The OCI initiator even did not responded requests for additional problem-specifying information.

> Have you enbled the event linkage for **BOR BUS2012 and event changed in t-code SWE2**.? If not 1st do that then check it (Thread 3-#2)-Request for basic checkup
> All the mentioned points by you have been checked already.... (Thread 3-#10) - *declination for non-novelty*
> I didn't see an answer to the question:
> Are the events being created, or not? Look in SWEL.(Thread 3-#14) – *Request for problem specifying information*

The OCI initiator however kept declining requests for basic checkup but asking alternative solutions and clear direction. Although such irresponsive attitude discouraged others' participation, the OCI initiator did not convey any sincere apology

or attempt to improve his attitude.

> If you have more information to add, please do so, but please stop re-posting meaningless additions to your questions. Especially not asking people to answer. Nobody here is paid to answer your question while you sit there and wait, and asking folks to give up their time to answer without you making any effort is not exactly fair, no?
> Please read the Rules of engagement, they are also there to help you get better answers. Don't take it personally, but learn from it. This is intended to help you and to improve the forum quality. (Thread 3-#11) - Problematic inquiry attitude
> You really should try looking in the online help sometime, you wouldn't be asking this question if you did because there's a lot of info about that - much more than anyone here is likely to post. And you don't even need to wait for an answer! (Thread 3-#18) — Problematic inquiry attitude

The OCI initiator's ill-mannered participation in the action domain to frame a problem made problem framing impossible. The OCI initiator received a few explicit directions to suggest a hypothetical solution (in the reply #7) and to derive crucial problem-specifying information (in the reply #21). Such suggestions were neither appreciated not responded properly; the OCI initiator never provided details and expended any minimal effort to understand them; e.g., "What do I need to check exactly. (#16)"

The OCI initiator suddenly indicated that he found a problem cause and his problem was removed. However, the OCI initiator's problem diagnosis and solution was considered as erroneous and could not be considered as a working solution. One participant raised the issue recognizing the misperception. However, the OCI initiator never returned.

> In SWELS, I had to remove BUS2012. That was creating the issue. (Thread 3-#18)- Problem diagnosis and adequate success
>
> SWELS turns the event trace on and off, what do you mean "remove BUS2012"? How could removing BUS2012 from anywhere cause events to be created?

Thread 3 exemplified how an ill-mannered OCI initiator broke down moves among action domains and blew out opportunities to get helped from others and to derive a

working solution. Despite of nine participants' goodwill to help, the OCI initiator did not appreciate their contributions and took them into serious account.

Thread 4. Open Collective Inquiry with Degraded Closure

Thread 4 began with a very short and abstract problem description in the action domain to initiate inquiry. The OCI initiator asked about the most recommended swap size, but only provided minimal information about his context. It seemed that the OCI initiator asked for others' opinions about the swap space in advance without confronting with any actual problem.

> I have a **32 bit** version of Linux (any distro) running with **4GB of RAM**.
> What would be the **maximum recommended swap space**? (Thread 4-#1) – problem context and inquiry objective

The short problem description in its original posting was so vague that prospective participants could make only a contingent suggestion based on general knowledge and conjecture. A participant in the reply #2 pointed it out, implying that the OCI initiator's problem description was too abstract to make any practical suggestion. The OCI initiator quoted the suggestion and requested the participant to confirm his belief about the swap space issue.

> Depends on what you are going to be doing.
> If you're doing heavy video editing with your 4GB of RAM, I'd use another 4GB swap. If you're just doing general computing with some gaming and whatnot, you can probably get by with 1GB or less. (Thread 4-#2) – Suggestion based on general practice.
> But anything over 4GB of swap space would be a waste, isn't it?
> As this is a 32 bit OS. (Thread4-#3) – Request for confirmation and additional information

Although the OCI initiator seemed to believe that he was ready to exchange opinions about practical recommendations, other participants did not agree. They complained

about the inadequacy of information provided for problem framing. One participant in the first quotation below pointed out that a general rule could not help his problem and criticized the OCI initiator's improper attitude in providing essential information for others to make relevant suggestions. Another participant also pointed out that the initial question was so vague and needed to set a boundary to receive useful contribution. However, the OCI initiator never returned to this discussion thread to address such advices.

> You didn't give us any clue what background jobs you're even going to run. (Thread 4-#4) – Inquiry norm: problematic attitude
>
> That seems like an odd question; if I scour round the internet looking for odd recommendations I'm sure that I can find some that are insanely large; 32G or more. (Thread 4-#8) – Inquiry dis-justification: Incorrect assumption

Despite such an inadequate problem framing, several participants made suggestions and shared opinions about the issue. For example, the participant in the reply #4 denounced one assumptive condition that the reply #2 used in making its contingent suggestion; that is, video editing in a 32 bit system was not a relevant example to use because it took up most of the machine's capacity. Participants seemed to agree with one general rule that swap space for the OCI initiator's system should be limited to 2GB or less under a normal task condition. However, in the reply #9, one participant with a strong voice contradicted the general consensus, repudiating it as wrongful recommendation. The participant in the reply 4 returned to contradict the contradiction in the reply #10, arguing that # 9 was not relevant contribution for what the OCI initiator inquired about initially (See the first quotation below). Then, the discussion thread became heated by arguments between the contradictory opinions regarding the relevance ad the validity of contribution (See the three quotations below).

> I don't think this thread is about swap or memory use on a typical system. The OP has at least implied it is about unusually high swap use. (Thread 4-#10) – Inquiry flow: exclude irrelevant contribution
>
> For someone that is smart can be stupid like some others. (Thread 4-#11) – Flaming: sarcasm
>
> I disagree with almost everything in your last post, but it is obviously pointless to try to refute it detail by detail (Thread 4-#13) – Flaming: false statement
> Bad turn of phrase, I guess. I believe the point they're trying to make is that the physical memory footprint for 32 bits is 4GB, not that 4GB of RAM will be completely used. (Thread 4-#14) – Correction of misunderstanding

Although one participant recognized that such argument was no use for the OCI initiator's inquiry and the discussion thread drifted, he was also more inclined toward self-satisfying motivation to prove his knowledge (see the quotation below). In validating other statements, participants used partial quotations heavily (e.g., Thread 4-#4, #8, #10, #13, and #16). This made the thread even more diverged into multiple topics many of which did not necessarily respond to the original posting and became populated with contributions made from self-satisfying motivation, such as proving one's expertise, and those rejecting such contributions. The thread degraded without deriving a converged agreement, and there was no proof that showed whether the OCI initiator obtained desired knowledge.

> Apologies to the OP, but I think we have drifted some way off helping you,
>
> but there is some, err, misunderstanding or mis-expression, in this thread and I really don't like the idea of deceptive material hanging around. (Thread4-#16)- Apology and flaming

Thread 4 demonstrated how poorly performed action domains resulted in ineffective and degraded open collective inquiry. The OCI initiator barely attempted to guide his inquiry flow, even when his intention for inquiry was arbitrarily interpreted. He also did not respond others' advice and requests for problem-specifying information to frame a

problem. As such, the OCI initiator did not expend any effort to vitalize action domains to maintain commitment, to guide inquiry flow, to frame a problem, and to negotiate solutions. It was no wonder to observe the discussion thread degraded due to immaturely performed action domains.

Table 9. Four Discussion Threads Exemplified

	Thread 1	Thread 2	Thread 3	Thread 4
Action domain to initiate	-Rich description of "real" problematic situation in various representations -Attempts to justify problem inquiry Shared knowledge from prior efforts	-Data-driven problem description -Indication of inquiry objectives	-Short problem description -Indication of inquiry objective	-Inquiry objective -Opinionating issue -General background
Action domain to maintain commitment	-Tension between inquiry justification and dis-justification -Encouragement and empathy	-Moderate inquiry dis-justification -Continued involvement	-Critique on inquiry manner	-Inquiry dis-justification -Critique on impolite attitude
Action domain to guide inquiry flow	-Appreciation and name calling -Frequent updates on inquiry progress -Specific demand	-Introduction of another issue	-Apology -Multiple requests for help	-Flaming/de-flaming -Irrelevant contribution
Action domain to frame a problem	-Multiple problem diagnosis -Additional problem descriptions both on request and voluntarily	-Additional problem descriptions on request -Problem diagnosis	-Additional problem description on request	-Problem diagnosis -Additional problem description
Action domain to negotiate solutions	-Multiple suggestions and follow-ups -Validation on suggestions	-Suggestions and follow-ups	-Declination of suggestions -Requests for explanations on suggestions -Directive solution	-Denouncement of suggestion -Solutions based on general warrant
Action domain to confirm workability	-Presentation of detailed, data-driven outcome -Post production of a working solution	-Indication of success –Request for explanation	-Indication of ineffectiveness	

I summarized the four illustrative cases in Table 9. The cases showed that adequate development of each action domain was crucial to make open collective inquiry successful. In each action domain, particular types of dialogic actions were faithfully fulfilled in order for open collective inquiry to progress toward an effective closure. For example, an action domain to initiate inquiry needed to adequately demonstrate a problem inquired about (e.g., Thread 1). If the initial demonstration was incomplete, the OCI initiator should provide additional information requested in the action domain to frame a problem. Adequate problem framing was a necessary condition to negotiate solutions. Hypothetical solutions suggested in the action domain to negotiated solutions were properly validated and supported to derive an agreeable working solution. The entire problem solving process needed to be properly justified and coherently procured.

4.2. Dimensions of Dialogic Actions

Characterizing six action domains based on distinct purposes of dialogic actions, I recognized that dialogic actions performed their purposes in particular ways. Understanding how dialogic actions perform their purposes could provide a more systemic and in-depth understanding of open collective inquiry processes. Three dimensions emerged during the transition between open coding and axial coding: *action performed*, *content of action*, and *argumentative component*. I corroborated these three dimensions using pragmatic communication theories such as speech acts theory (Austin 1962; Searle 1969) and argumentative theory (Toulmin 1958). In online forums, asynchronous written communication — writing and reading — replaces oral communication — speech and hearing. This might make it problematic to plainly adopt pragmatic speech theories built upon oral communication. I excuse the potential concern

for two reasons. First, based on Ong's argument (1983), I believe that orality is conflated with literacy in the technology-mediated situation. Furthermore, textual communication in online forums maintains the cognitive benefits of textual communication, such as increased human capacity for knowledge retention, distribution, retrieval, reproduction, and external evaluation that are quite limited to oral communication. Second, the premises of pragmatics maintain its credibility in both communication modes, because they intend to do things by coordinating actions rather than simply to represent things. Since my objective is to investigate actions shaped by language, the application of pragmatics to online communication is relevant.

4.2.1. Action Performed

Austin (1962) introduced the concept of the speech act, claiming "the issuing of the utterance is the performing of an action" (p.6). He categorized three types of speech act: "The locutionary acts which have a meaning—definitive sense and reference; the illocutionary act which has a certain force in saying something; and the perlocutionary act which is the achieving of certain effects by saying something" (p. 120). Austin called the force issued in illocutionary acts and perlocutionary acts "illocutionary force—different types of function of language" (p.99). The illocutionary force involves convention in the sense that illocutionary acts need conform to convention to be issued explicitly, while perlocutionary acts are completed by consequences, either intended or unintended; He formulated the former "*in* doing *x* I was doing *y*" and the latter "*by* doing *x* I was doing *y (pp. 122~123)*." In doing so, he claims to "consider the total situation in which the utterance is issued—the total speech act" (p.52). He asserted:

> There must exist an accepted conventional procedure having a certain

conventional effect, the procedure to include the uttering of certain words by certain person, in certain circumstances (p.26).

Table 10. Comparison between Austin's and Searle's Classifications

Austin's Classification of Performatives

Classes	Definition	Examples
Verdictives	The delivering of a finding, official or unofficial, upon evidence or reasons as to value or fact, so far as these are distinguishable	interpret, convict, find, estimate, locate, diagnose, describe, analyze
Exercitives	The giving of a decision in favor of or against a certain course of action, or advocacy of it	appoint, degrade, dismiss, order, command, claim, choose
Commisives	The promising or committing the speaker to a certain course of action	propose to, engage, pledge myself, bet, consent, espouse
Behavitives	The notion of reaction to other people's behavior and fortunes and of attitudes and expressions of attitudes to someone else's past conduct or imminent conduct	apologize, thank, commiserate, compliment, resent, welcome, bless, defy
Expositives	The expounding of views, the conducting of arguments, and the clarifying of usages and of references	affirm, state, deny, emphasize, illustrate, answer

Searle's Classification of Illocutionary Acts

Illocutionary acts	Illocutionary point	Word-world fit	Sincerity condition	Definition
Representatives	Belief	Words to the world	Truth	To commit the speaker to something's being the case, to the truth of the expressed proposition
Directives	Attempt	World to words	Want	To get the hearer to do something
Commisives	Commit	World to words	Intention	To commit the speaker to some future course of action
Expressive	Express	No direction	A state of affairs	To express the psychological state
Declaratives	Declare	Both	None	To change the reality in accord with the propositional content

With these clear distinctions in mind Austin deliberately sought an apparatus by which the speaker can deliver the illocutionary force explicit to the hearer to generate anticipated performative effects consequently. In particular, he derived a classification of

performative verbs that identifies varying ways of exhibiting an attitude toward the hearer. Based on that list he classified five types of performatives: "the verdictives is an exercise of judgment, the exercitives is an assertion of influence or exercising power, the commisives is an assuming of an obligation or declaring of an intention, the behavitives is the adopting of an attitude, and the expositive is the clarifying of reasons, arguments, and communications" (p. 162). Instead of focusing on conventions of particular verb uses as a key component of speech acts, Searle introduced the notion of illocutionary points and the fit between word and world to classify illocutionary acts in relation to intention and reference. He proposed an alternative five classes of illocutionary acts: representatives, directives, commisives, expressives, and declaratives (Searle 1976). I compared the two classifications in Table 10.

From these classifications, I chose five classes of performatives to characterize the dimension of *action performed*: *declaratives*, *expositives*, *directives*, *commisives*, and behavitives. I labeled the dimension "*action performed*" ─ instead of performatives or illocutionary acts ─ to highlight implicit or explicit purposes of dialogic actions rather than particular verb uses or a statement as a whole. I summarize adjusted definitions, examples, and corresponding quotations of the five classes in Table 11.

Table 11. Five Classes of Action Performed in the Present Study			
Classes	Definition	Examples	Quotes
Declaratives	To evaluate the truth or trustworthiness of other statements	inquiry dis-justification, problem diagnosis and consolidation, validation of solutions and opinions	*The error you are facing generally arises when actual agent cannot be determined. (S6-#10)*
Expositives	To exhibit facts, opinions, and explanations	Problem justification, description, and specification, correction, explanation	*For other workflows I have never found such issue, I mean after doing it as General task and after assigning the agent in the expression it used to go as a workitem of that particular agent but here it is going as workitem of initiator as well, which is logically not correct. (S6-#8)*
Directives	To get the hearer to do something or to request the hearer's action	Request of detail and explanation, and fulfillment, observation of norm	*Since your disks are different sized (80GB and 40GB), you should make new partitions on a new one, by using fdisk or parted, then format it with any file system that you prefer. Then rsync all the files. Everything will be much faster now (L22-#13)*
Commisives	To commit the speaker or the hearer to do some future course of action	Commitment, future direction, support for other statement	*My intention for this thread was to find out others opinion about if RAID is really as wonderful as "they" promise you on paper. Does it prevent me from losing data when "one" disk fails or is the chance of having a snowball effect just as high, having an other disk failing after an other?(L5-#35)*
Behavitives	To give or take dialogic reaction or attitude to other statements	Flaming/de-flaming, quotation, designation, greeting, appreciation, excuse	*Sorry I'm not being more helpful. (L33-#10)*

A class of *declaratives* refers to dialogic actions that evaluate the truth or trustworthiness of prior statements. For example, problems that were raised in original postings or newly introduced during dialogues were not only further specified through subsequent

exchanges of additional details, but also, more importantly, they were requested to prove themselves as crucial and practical issues for open collective inquiry. Likewise, suggested solutions and opinions were assessed for their relevance and significance instead of being adopted immediately without any problem.

Dialogic actions that belong to a class of *expositives* intend to demonstrate things, such as facts, opinions, and explanations, without any attitudinal or judgmental valence. Such dialogic actions include justifying problems, describing problems, providing problem-specifying details, following up prior statements with additional information, and presenting opposite or contradictory opinions.

A class of *directives* refers to dialogic actions that request the hearer's action, such as requesting problem details and explanations on suggested solutions. Solutions could be given in a *directive* manner when a solution provider urged the hearer to carry out his or her solution either implicitly or explicitly. When dialogue participants indicated desired knowledge or inquiry directions, they requested others to provide relevant contributions to manage open collective inquiry processes coherently. They also raised issues regarding inquiry norms when questions and suggestions were given in an inappropriate or unconstructive manner.

A class of *commisives* denotes dialogic actions that demonstrate the speaker's commitment to open collective inquiry in order for participants to carry on open collective inquiry. Participants expressed interests toward problems raised or indicated

expectations for constructive contributions. Participants reminded others of pending problems to revitalize stagnant inquiry progresses as well as specified difficulties that impeded their inquiry progresses. Such demonstrations of commitment were also found in dialogic actions that supported prior statements. By supporting prior statements, the speaker committed himself or herself to what the prior statement asserted.

There were such dialogic actions that did not include explicit or implicit purposes for open collective inquiry processes but were elementary to dialogue flow like a backbone structure. I classified such dialogic actions as behavitives such as greeting, appreciation, excuse, and designation and grounding using name-calling and quotation of prior statements. Flaming was observed dialogic actions in all three forums. It considerably impeded and derailed dialogue flow while flamed participants defended or reputed irrelevant and emotionally charged criticism. Negative evaluation or disbelief toward others' statements was implicit in flaming dialogic actions, but flaming was distinguished from *declaratives* in that flaming did not contain specific contents for open collective inquiry. For example, Thread 4 became degraded due to seemingly unnecessary argument over the relevance and validity of each other's statement.

4.2.2. Content of Action

I further specify purposes of dialogic actions that belong to an identical class of *action performed* depending on varying kinds of content. For example, the purpose of problem dis-justification could be performed in several ways. An utterer could denounce the truth of a problem raised by arguing that the problem could be avoidable through an alternative solution, that it was a general one that did not have any solution at the

moment, that it was misperceived one due to the hearer's wrong expectation, that it was in an irreparable condition, or that it was insignificant.

> Anyhow, my basic point is that you don't really need to be able to boot from a USB drive. (L24-#8) – *Avoidable problem*
>
> Everybody has this problem. It is just how USB works in any operating system. (L1-#2) – *General problem*
>
> HTML_FORMAT is very basic; it is modeled on (and is a subset of) the HTML capabilitiesof TextField. I'm attaching a document outlining what is/isn't supported by this format. Specifically, styleName isn't. (A12-#2) – *Wrong expectation*
>
> I don't understand. If you cannot re-format the card (in your computer or in the camera) just discard it. There's nothing to repair. (L6-#11) – *Irreparable condition*
>
> Users will have to upgrade. But folks usually do this pretty quickly after a release. (A10-#14) – *Insignificant problem*

Likewise, flaming belonging to behavitives could be performed by simply denying the truth, by doubting the trustworthiness, by mocking the value of others' contributions.

> I was bothered that the incorrect things you are saying would confuse other people reading this thread. I thought I should try to balance that. (L28-#13) – *False statement*
>
> As I said before no 'P' contest. Maybe your search engine is broke or your wiggle is not functioning. – *Poor trustworthiness*
>
> What's sad is he is at Guru level for having over 5000 posts. I wonder how many of those are equally devoid of expertise as the ones he's put on this thread? (L5-#30) – *Deprecation*

In this way, the dimension of *action performed* is not sufficient to characterize diverse purposes or intentions of dialogic actions; the diversity of 195 types of dialogic action could be not reduced into five classes of *action performed* without losing their meanings significantly. This finding is in line with various criticisms on Austin's original conception of speech acts solely depending on illocutionary force laid in performatives. Cohen (1964) rejects Austin's mutually exclusive distinction between meaning and force

that presumes that meaning exists in locutions and is assessed for its precision and that force is exclusive to illocutions and is pursued for explicitness. The illocutionary force is an aspect of meaning of an utterance that conveys what the speaker anticipates the hearer to do by the utterance. Strawson (1964) criticizes the vague definitions of convention in distinguishing illocutions as conventional acts from perlocutions as non-conventional acts. He argues that illocutions can be performed on the meaning of an utterance without conforming any kind of accepted convention and that the nature of illocutionary force is indeed the speaker's intention to produce an effect. The hearer's recognition of the intention of an utterance and the response to it are inseparable constituents of effective performatives.

Searle (1968) points out that locutions and illocutions are "two different labels for the same acts" (p.407) and that there can be multiple ways of distinguishing them, i.e., trying and succeeding, literal meaning and intended meaning, and propositional acts and illocutionary acts. He views that an utterance can be enriched in the context; "The speaker communicates to the hearer more than he actually says by way of relying on their mutually shared background information, both linguistic and nonlinguistic, together with the general powers of rationality and inference on the part of the hearer" (pp. 60-61, Searle 1975). Even incomplete and incorrect utterances can gain the right meaning and that it is comprised of all meaningful components. Thus, He recognizes that what Austin really distinguished is propositional content and illocutionary force whose distinction is more or less specific in a sentence. The sentence is viewed to contain an illocutionary force-indicating device (F) and a propositional content indicator

(p) — F(p), and F operates on p indicating the direction of fit between the propositional content and reality. He further criticizes Austin's assumption that paradigmatic performative verbs constitute performatives correspondingly — the conditions of adequacy, because an utterance by itself cannot guarantee any action and its sincerity (Searle 1989). In this way, an identical statement can read differently and augment additional meaning. Meaning of a statement, or illocutionary force, cannot be "injected" to the hearer by the speaker's particular linguistic apparatus or cannot secure uptake of its explicitness. The speaker is obliged to elucidate the meaning, while the hearer actively pursues adequate understanding and belief. Critical here is the sense making of "meaning" situated in practical contexts and the communication between the speaker and the hearer.

I labeled such meaning unit of dialogic action "*content of action*." 195 types of dialogic action identified from open coding contained unique meanings but were too divergent. Thus, I considered conditions of these contents of action to organize them in a systemic and manageable mode. First, the condition of felicity (Austin 1962) was taken into account. The Speech acts theory underscores the equivalent criticality of ordinary language-in-use in understanding everyday social practices and inquiries, as opposed to the conventional emphasis on privileged formal logic and descriptive semantic and syntactic language in pursuit of absolute truth. The validity of such statements is verified only by the performance of action intended in the statements and assessed by the doctrine of infelicities, which is distinct from constative statements whose validity is verified true or false on syntactic proposition. Therefore, contents of action were sorted

by three kinds of felicity conditions ─ felicity, infelicity, and non-felicity.

Second, I considered the directions of interaction ─ response giving and response taking. When an utterer states an utterance, the utterer indicates what he or she expects to receive from a hearer as a response. For example in the online forum situation, when a person proposes a possible solution for other's problem either in *directive* action or in *expositive* action, he wants the person to carry out the solution or, at least, to notify how the person understands the proposed solution. The direction of such illocutionary force has often been exemplified in unidirectional speech situations where the utterer produces force and where the hearer interprets meaning of the force. However, dialogue is the flow of thoughts and ideas through which participants exchange to construct shared meaning (Bohm 1996; Clark 1996). The direction of force, here, is multidirectional and lateral among participants. Individual participants continuously alternate between the positions of the utterer and that of the hearer, as they construct their statements by grounding upon shared understandings and referring to prior statements. How participants give their thoughts and how they take others' thoughts are two complementary actions. Adjacency pair is an instrument of conversation analysis that investigates the complementary coupling of force and meaning (Sacks and Jefferson 1992). However, the complicated unfolding processes of dialogue in online forums made it difficult to follow how adjacency pairs shape the processes. So, I considered the two actions separately as response giving and response taking.

The third condition emerged while sorting 195 types of dialogic action onto the condition of felicity and the condition of interaction. Contents of action that sorted for

an identical dimension demonstrated varying degrees of reflection that participants exercised to produce or interpret contents of action. For example, when one was given other's responses, he could take or reject it with or without explicit sense making of the given responses. Likewise, when one gave a response, he could create the response drawing upon prior statements or generate it independently as if he intended to communicate exclusively with a hearer. In this way, I identified nine classes of contents of action. The nine categories and examples are listed in Appendix C (Coding 3).

However, I acknowledge that the nine categories of content of action, which were derived from the three conditions, were found to be complicated during the percent agreement review in Section 3.2.4. I proposed reducing them into five categories based on the felicity condition and the reflection condition. Removing the direction dimension, the five-category coding could be manipulated by combining prior coding that was distinguished by the direction condition (Table 12). For example, constructive response giving and compliant response taking can be combined together based on shared felicity and non-reflection conditions. Although I concerned that such manipulative combining could mingle up the idea of the original coding, I believe that the conciseness and consistency of the five categories would be more than such risk. Thus, I adapted to the five categories of content of action in demonstrating and discussing the rest of this dissertation. However, to reduce significant confusion due to this transition, I preserve the labels of the original nine categories in demonstrating findings associated with the dimension of content of action.

Table 12. Reduced Five Categories of Content of Action

		Reflection condition	
		Reflection	***Non-reflection***
Felicity condition	***Felicity***	**1. Felicitous reflective content** Supportive response giving Assimilative response taking	**2. Felicitous unreflective content** Constructive response giving Compliant response giving
	Infelicity	**3. Infelicitous reflective content** Confused response giving Challenging response taking	**4. Infelicitous unreflective content** Unsupportive response giving Declining response taking
	Non-felicity	**5. Conversation element**	

The felicitous reflective content is given when an utterer properly understands and agrees with other's statement and demonstrates explicit sense making (reflection) of content of the statement in deriving her statement. *Supportive response giving* and *assimilating response taking* belong to this category. *Supportive response giving* included contents that were built upon prior statements with support for or belief in them. Emotional encouragement, continued involvement and interest, and follow-ups and confirmations on prior contents were categorized here. Likewise, *assimilating response taking* explicitly demonstrated how an utter internalizes others' statements and derived affirmative opinions.

> I totally agree. For $250 this board should damn near make me breakfast every morning in addition to working properly. I can honestly say that this is the first time that I have been seriously disappointed in an **Asus** product. My last board was an A8V-SLI Premium and it ran like a dream. Getting the **M3N-HT** working thus far has been a pain in the ass. – Supportive response giving: empathy
>
> Calibration was a pain: the evtouch program seems to calibrate, but then doesn't write anything to the file. I did use it to find the min/max which I entered in xorg.conf, then added Option "x0" "3" and so on for y0, up to x8,y8. Beware that x0,y0 is lower left, x2,y2 lower right, and x8,y8 upper right. The parameter is by how many pixels to move the cursor to bring it under the pen. Positive X is to the right, Positive Y is down. (L14-#18) – Assimilating response taking: post production of solution

The felicitous unreflective content is given when an utterer adequately understands and agrees with other's statement but derives her statement without clear reflection of the statement. An utterer provided this type of content because the prior statement did not contain explicit content to build up or because she initiated open collective inquiry. *Constructive response giving* and *compliant response taking* are combined together in this category. *Constructive response giving* included contents of original postings that an OCI initiator provided to initiate open collective inquiry when she recognized problematic situation but did not have any prior statements to build upon. Also, contents that were provided in response to what other's statement inquired or requested were included in this category because these contents did not use contents of the request or inquiry. *Compliant response taking* demonstrates the utterer's commitment and promise to consider other statements. Although an utterer apparently had another contrasting opinion, she provided this type of content to acknowledge other's statement.

> Sometimes there was a "\t" inserted and/or a TextLayoutFormat applied to a FlowElement. When scrolling or clicking in this structure it was giving the #1009 Error. In some cases it would give an undefined error mentioned in earlier reply, I think the undefined error happened when you clicked around the "\t" or empty space created by a paragraphStartIndent or textIndent.(A9-#12) – Constructive response giving: description of problem symptom
>
> I know that it's quite overwhelming and there might be other solutions there in education the user to write the mixed/bidi string in certain order (A8-#10) – Compliant response taking: diversity
>
> I'm happy to collect more info and help with the updating of this driver to make it more robust/versatile for more users if possible (L4-#30) – Compliant response taking: Promise of sincere undertaking

The infelicitous reflective content is given when an utterer poorly understands or disagrees with other's statement and thus uses content of the statement to validate its truth/trustworthiness and overcome the infelicity. *Confused response giving* and

challenging response taking are bundled together in this category. *Confused response giving* intended to recognize possible sources of the infelicity and to overcome it by requesting details, additional information, and better ways of inquiry. In a similar vein, controversial issues presented in an original posting were considered as *confused response giving* because a OCI initiator demonstrated her confusion based on the content. Frustration and discouragement were sorted into this category because an utterer demonstrated such contents to elicit help. *Challenging response taking* was provided when the hearer took content of other's infelicitous statements to resolve the infelicity. The hearer's deferred response taking in order to clear the truth of given statements was one example of this category. Reports of ineffective/limited workability of proposed solutions were also sorted in this category because such contents were possible only because the utterer takes the solutions into his reflection and experimentation.

> Are you able to produce this in any of our sample applications? What build are you using? The labs release a version of the SWCs from Flex Gumbo? (A15-#2) ─ confused response giving: request for details
>
> I'm getting pretty near the end of my rope and will probably just format and reinstall Linux. I tried the download for clonezilla...almost 4.5 hoours at 56k...much too long without access to Wifi or DSL. (L22-#17) ─ confused response giving: frustration
>
> I'll have to Google to get what you're saying...unless you'd care to clarify. (L11-#18) ─ Challenging response taking: deferred acceptance
>
> Here is the update: I installed Centos 5.3 32-bit but had errors loading Operating System. I got the message at the end of the install stating that the OS was installed successfully, but instead of booting I got the signature "Error Loading Operating System" in the top left corner of the screen. (L9-#11) ─ Challenging response taking: ineffective workability

The infelicitous unreflective content is given when an utterer poorly understands and disagrees with other's statement and intends more to indicate the infelicity rather than to overcome it. *Unsupportive response giving* and *declining response taking* belong to this

category. *Unsupportive response giving* denies or criticizes prior statements to end any further dialogue associated with them. It demonstrated dissatisfaction, doubt, dis-justification of other's statements, disparaging poor understandings, and deprecating evaluation and attitude are common substance of this type of content. *Declining response taking* is given when the hearer intended not to consider given statement outright due to apparent ineffectiveness or invalidity of the statements.

> In some BIOS you need to tell it its a optical-drive (eg. CDROM)
> These BIOS don't accept the interrupt ejecting the drive if it thinks it a HD (L8-#31) ─ unsupportive response giving: wrong assumption
>
> I understand from your last question that you don't read/know any rtl language, because when you read from RIGHT TO LEFT the order is not as logical as an array would (want to) be, explanation: the first word is the one that appear on the far right of the string (what you'd consider to be the last one) advancing one word at the time towards the left, but when this sequence encounters an RTL string it should treat it as a "sub string" of the parent string with it's own grammatical order, so what would the last word on the left (or the first word for English speakers) which means that we JUMPED one word is actually the next word in sequence - even though it is not displayed as such. (A13-#10) ─ Unsupportive response giving: poor understanding
>
> I don't know if I can or cannot reformat my picture card. I didn't try it. I don't want to format it. I want to recover my pictures. (L6-#12) ─ Declining response taking: irrelevance
>
> I doubt the rumors that MSI motherboards consume less power than ASUS or the other way around. Again it is about total power consumption. The brand has nothing to do with it.(L18-#9) ─ Declining response taking: Wrong assumption

Conversational element is those contents that did not contain either a felicitous condition or an infelicitous condition, such as greeting, appreciation, name calling, and excuse. Quotations of a prior statement were an important way for an utterer to indicate to which of prior statements he points out. Utterers quoted a whole or parts of a prior statement, and sometimes, they quoted their prior statements to remind others of their continued focus. Quotations were common and crucial to dialogues in online forums where participants could not attend to a dialogue simultaneously. It was a convenient and

effective way to retain contents of prior statements, so future respondents needed not to go back or search back contents of the prior discussion.

4.2.3. Argumentative Components

I recognized that about 20 percent of contents of action include types of components that fortify meanings in particular ways. Most dialogues in online forums sampled for the present study dealt with problem solving. Here, how to describe problems and how to exchange information to negotiate solutions were crucial because an individual participant could access others' problems or solutions only through interpreting their statements. Adequate and relevant descriptions of problems were considered as an important norm of online forums to generate constructive open collective inquiry. At the same time, contributed hypothetical solutions and opinions were more likely to be questioned for better sense making rather than taken outright. Indeed, much of dialogue in online forums was filled with dialogic actions requesting details and explanations for clear understandings and verifications.

> Since you say this has happened "again", you know that we need much more information than this and you know what sort of info we need. You cannot expect us to hunt through past posts to find out what your hardware and connection methods are. (L25-#2) ─ Norm for problem details
>
> Which bug are you talking about? Surely, 10.1 is a beta so that we can test it and have things fixed for 10.1 final release or 10.2? Are you serious about FP11? If so, FP 10 will live on with busted FTE? (A20-#34) ─ Request for clarification on suggested solution

A well-elaborated problem description itself was a more persuasive device to invoke others for attention and commitment than insistent solicitations for help, and it was also clear for potential participants to decide what to contribute. Likewise, solutions and opinions needed to be provided with reasonable grounds to be appreciated, or they were

doomed to be contradiction and denouncement for their trustworthiness and validity.

Recognizing such persuasive aspects of dialogic actions, I adapted to Toulmin's theory of argumentation (1958) to characterize such components. Toulmin questioned the value of formal reasoning based on syllogism and its ability to attain truth in practical contexts. Instead, he argued that "logic is a development of sociology rather than psychology" (p.3), indicating that practical reasoning using ordinary language are specific to context and influenced more by habit and practices through social evolution rather than by the valid inferential structure. Thus, the aim of practical reasoning is to achieve "the soundness of the claims we make ― with the solidity of the ground we produce to support them, the firmness of the backing we provide for them ― or, to change the metaphor, with the sort of case we present in defense of our claims" (p.7). He envisioned argument as a three-stage event consisting of a claim, supports for the claim, and judgment on the claim. The instrumental criteria for constructing and evaluating a claim are its probability ― trustworthiness and reliability. Toulmin proposed a layout of argument as a way of practical reasoning in place of syllogism (See 3.2.3). He introduced claim, data, and warrant as essential components of argument; claim refers to conclusions whose merit must be established; data are the facts that become a foundation for the claim; and warrant sets a legitimate and consistent relation between a claim and data. In addition to these essential components, backing, qualifier, and rebuttal are viewed to supplement an argument; backing is credentials that certify the relation between the claim and data; rebuttal is a statement that indicates contradictory

conditions to the claim; and qualifier refers to words or phrases that express a degree of force, implied general injunction, in the claim.

In the present study, participants of online forums proposed statements for specific reasons, and these statements were further supported or evaluated for their plausibility and reliability by others. For example, questions about problematic situations were requested to justify their trustworthiness, and suggested solutions were validated for their acceptability. I identified five components regarding argumentative purposes and characterized them reflecting on the layout of argument: data, personal warrant, general warrant, backing, and qualifier. I summarized how I reinterpreted the original definitions of *argumentative components* in the context of open collective inquiry in Table 13.

Table 13. Types of Argumentative Components

	Toulmin's definition	Adapted uses	Examples
Data	Facts that become a foundation for the claim	Facts that are not interpreted	picture (snapshot), number, code set
General warrant	A legitimate and consistent relation between a claim and data	Statements that use general practice to support the reliability of a claim	It is so because that is what others believe so.
Personal warrant		Statements that use personal practice to support the reliability of a claim	It is so because that is what I do effectively
Backing	Credentials that certify the relation between the claim and data	Indications that lead to sources of warrants	hyperlinks to resource, references
Qualifier	Words or phrases that express a degree of force	Words or phrases that express a degree of force	probably, impossible, certainly, presumably

Data in the present study refers to an explicit ground of a claim. However, it is distinguished from the original definition in that it refers to facts that are presented without interpretation. Data, such as code set, snapshot, and number, were preferably

used for describing problems because textual descriptions based on an utterer's observation was likely to be incomplete and misleading. Data enabled potential contributors to access the problems most directly and to diagnose problem causes more neutrally.

> Don't see any source attached here. Complete source including the GIFPlayer all zipped up would be much appreciated. (A18-#21)
>
> When you make your other thread try and give the others background information so they don't suggest things you've already tried, ie post: the 'ls -l /usr/bin/lspci' output, 'lspci --version' output, and 'uname -a' output. (L16-#20)

Warrant is defined as statements that support the trustworthiness of a claim, and it contains why clauses ─ why what I say is valid either implicitly or explicitly. I discerned two types of warrant: general warrant and personal warrant. General warrant is statements that endow the validity to a claim. For example, when an utterer suggested a solution, he could make it more acceptable by providing examples of general inferences or practices.

> Actually this is a good case of why CLASSES in Workflows are better -- you would already at the CLASS CONSTRUCTOR stage have got the instance of the WF and so you would be in business straight away. For each method in the class you would already have the attributes so problem solved. You can still call a function module in a class BTW. (S10-#14)
>
> It seems a lot of people are still hard headed that thinks that they do not need quad core or multiple processors for multitasking. Linux is a multitasking OS, so more processors is better. Intel Core 2 Duo processors need to have its memory controller clocked at 1333 MHz to really provide the performance, so DDR3-1333 is not cheap. AMD systems does not need very fast RAM because its memory controller easily out does the throughput of Core 2 Duo systems that are using DDR3-1333. AMD systems can use DDR2-800 without a lost of performance. IMHO, AMD total setups are cheaper. (L13-#14)

The other way of establishing such acceptability of a claim is using personal practice, experience, and expertise that imply that an utterer's practices and experiences are enough to guarantee that and I am a reliable knowledge source.

> I do not use them because I prefer not adding a line to /etc/fstab to ease mounting external storage devices instead I mount them manually. This takes more time, but I can mount it as read-only if I want to just browse the files with out editing them.(L1-#4)

> In my case I have a long run of text and need to call recreateTextline with a previousLine. In your case you call recreateTextLine with a null previousLine. This appears to be the difference. Also, note that my test occur after a content change which cause the lines to go invalid. No static validity is applied as in your case. (A20-#31)

> but I'm in repair business and recent (last 4 years) hp/compaq laptops are frequent motherboard replacement candidates. In machines in question the freezing time shortens as the problem progresses and eventually machines fail to POST and produce any video. (L31-#11)

Backing adds additional justification to warrant, and I considered direct links and references as backing in the present study. These elements allowed others to access the same knowledge resources that an utterer used to construct a claim and provided opportunities to validate the trustworthiness of the warrant. In addition to such justificatory function, backing was used for supporting the acceptability of a claim directly or provided as a standalone statement with an implicit claim. For example, some contributors provided hyperlinks to resource as verified solutions, claims that could solve problematic situations.

> Support for the B3's on the Gigabyte board you're looking at still comes out sketchy, but as long as you run stock you should be fine. http://www.anandtech.com/mb/showdoc.aspx?i=3279&p=3 (L2-#16)

> As far as I've read in the **TLF Blog**, cascade lists and text wrapping around image will be possible in TLF v.2 which will be available officially in the next CS release which is great enough for me! If they only make so we can control thickness sharpness of the text.. that would totally mean goodbye old text fields, welcome TLF :-) Can't wait for TLF v.2, really! (A12-#17)

Qualifier identifies a degree of force that implicated in a claim. Particular words and phrases, such as modal adverbs, were used to express to extent to which a claim could be trusted. The force varies depending on the strength connoted in adverbs or adverb

phrases, such as teetotally, pretty sure, and probably.

> Keep that battery away from your laptop. **Teetotally!** (L30-#4)
>
> With 4GB on a 32 bit system, we can be **pretty sure** the foreground task (whatever program you're actively using at any moment) doesn't need any swap space. (L28-#4)
>
> After you've been in each of your applications once since the last reboot, you will **probably** have a lot of important file content and inodes, etc. in cache. (L12-#12)

So far, I conceptualized three dimensions of dialogic action: *action performed*, *content of action*, and *argumentative component*. The dimensions of *action performed* and *content of action* were essential in all types of dialogic action, while *argumentative components* were needed for further strengthening. These three dimensions were useful to characterize each action domain in terms of how to perform its unique purposes and to suggest composing relevant dialogic actions. For example, the action domain to initiate inquiry aims to demonstrate problems. The demonstration of problem could be adequately performed through *expositive* action containing initiative *constructive response giving*.

4.2.4. Distribution of Dialogic Action in Action Domains

I examined all text segments identified for open coding regarding the three dimensions of dialogic action in each action domain. Using the distribution of the dialogic actions in these dimensions, I characterized the six action domains focused on *how they do* for *what they do*. The distribution pattern of all dialogic actions across the three online forums was presented in Table 14. I highlighted dominant types of dialogic action in each action domain.

Table 14. Dimensional Characteristics of Six Action Domains

Action Domains	Action performed	Total	A	B	C	Content of action	Total	A	B	C	Argumentative components	Total	A	B	C
To initiate inquiry	declaratives	-	-	-	-	supportive g-	8	8	-	-	backing	8	5	2	1
	expositives	209	116	56	37	assimilating t-	-	-	-	-	data	36	21	14	1
	directives	-	-	-	-	constructive g-	302	153	81	68	personal w	-	-	-	-
	commisives	139	70	35	34	compliant t-	-	-	-	-	general w	1	1	-	-
	behavitives	117	57	24	36	confused g-	2	2	-	-	qualifier	1	1	-	-
						challenging t-	-	-	-	-					
						unsupportive	36	23	9	4					
						declining t-	-	-	-	-					
						conversational	117	57	25	35					
To maintain commitment	declaratives	51	27	15	9	supportive g-	244	155	64	25	backing	7	2	5	-
	expositives	53	28	23	2	assimilating t-	-	-	-	-	data	3	2	1	-
	directives	40	29	1	10	constructive g-	-	-	-	-	personal w	2	1	1	-
	commisives	199	116	59	27	compliant t-	42	27	9	6	general w	7	4	3	-
	behavitives	128	90	30	8	confused g-	32	22	7	3	qualifier	1	-	1	-
						challenging t-	77	41	33	3					
						unsupportive	71	43	15	13					
						declining t-	5	2	-	3					
						conversational	-	-	-	-					
To guide inquiry flow	declaratives	-	-	-	-	supportive g-	-	-	-	-	backing	13	8	5	
	expositives	-	-	-	-	assimilating t-	147	100	37	10	data	12	9	3	
	directives	195	119	47	29	constructive g-	-	-	-	-	personal w	6	6		
	commisives	205	122	58	25	compliant t-	20	15	5	-	general w	11	10	1	
	behavitives	1350	778	230	375	confused g-	-	-	-	-	qualifier	5	2	1	2
						challenging t-	215	109	64	42					
						unsupportive	54	47	6	1					
						declining t-	46	41	4	1					
						conversational	1350	756	219	375					
To frame a problem	declaratives	237	148	55	34	supportive g-	-	-	-	-	backing	27	20	5	2
	expositives	384	188	111	85	assimilating t-	18	15	2	1	data	124	78	39	7
	directives	339	176	60	103	constructive g-	500	267	133	105	personal w	24	15	7	2
	commisives	-	-	-	-	compliant t-	-	-	-	-	general w	19	10	4	5
	behavitives	-	-	-	-	confused g-	352	187	62	103	qualifier	22	16	2	4
						challenging t-	46	27	14	5					
						unsupportive	44	21	15	8					
						declining t-	-	-	-	-					
						conversational	-	-	-	-					
To negotiate solution	declaratives	297	211	52	34	supportive g-	169	108	44	17	backing	151	100	39	12
	expositives	553	371	105	77	assimilating t-	71	49	15	7	data	194	170	24	2
	directives	612	348	135	129	constructive g-	560	354	104	102	personal w	131	113	10	8
	commisives	-	-	-	-	compliant t-	-	-	-	-	general w	178	128	31	19
	behavitives	79	46	27	6	confused g-	150	65	45	40	qualifier	42	35	4	3
						challenging t-	204	122	41	41					
						unsupportive	203	142	43	18					
						declining t-	187	136	27	24					
						conversational	-	-	-	-					
To confirm workability	declaratives	27	16	10	1	supportive g-	-	-	-	-	backing	9	4	5	-
	expositives	221	126	59	36	assimilating t-	108	57	33	18	data	47	32	13	2
	directives	59	39	14	6	constructive g-	-	-	-	-	personal w	2	-	2	-
	commisives	-	-	-	-	compliant t-	-	-	-	-	general w	2	1	1	-
	behavitives	-	-	-	-	confused g-	34	26	6	2	qualifier	-	-	-	-
						challenging t-	68	47	16	5					
						unsupportive	3	2	1	1					
						declining t-	94	49	27	18					
						conversational	-	-	-	-					
		5572	3263	1206	1103		5572	3263	1206	1103		1087	794	223	70

Action Domain to Initiate Inquiry

In the action domain to initiate inquiry, demonstration and commitment were two primary purposes. OCI initiators performed problem demonstration using *expositives*. 45 percent of 465 dialogic actions identified in this action domain were *expositives* that demonstrated facts, opinions, observations, and explanations about problematic situations inquired. 36 percent of dialogic actions were *commisives* to express OCI initiators' motivations and willingness to get involved in inquiry processes. About 19 percent of this action domain was filled with behavitives expressing friendly gestures using greeting, a priori appreciation, and casual joke. It also included OCI initiators' a priori excuses for their inadequate expertise to resolve their problematic situations by themselves.

OCI initiators needed to provide contents describing problematic situations inquired about to initiate open collective inquiry. Thus, contents given in this action domain were mostly unreflective ones that had no prior statements to reflect upon. 65 percent of the contents of action that provided information about problems were identified as *constructive response giving*, conforming the purpose of problem demonstration. Although confronting with a problem was not a happy situation, OCI initiators were positively motivated for resolving the situation through open collective inquiry. They fully understood the trustworthiness and value of their initiatives. About eight percent of the contents of action reported unsuccessful prior inquiry efforts

as an evidence of prior efforts and problem occurrences. Thus, these contents were viewed to be in felicitous condition. Some contents were infelicitous and reflective when OCI initiators intended to demonstrate that problematic situations inquired about defying their prior knowledge and beliefs. Such *unsupportive response giving* comprised of eight percent of the contents in this action domain. A quarter of contents were conversational elements such as greeting and appreciation.

36 out of 80 original postings sampled for the present study used data to substantiate their statements, such as code sets, attachment files, and snapshots. 32 of them included data in *constructive response giving* to describe problems, and four provided data as evidence of failed prior efforts in *unsupportive response giving*. The use of backing was observed in eight original postings; OCI initiators provided hyperlinks to resources as a starting point of an intended inquiry direction; or they provided them as references with which they made initial opinions on their problematic situations based on such backing components.

OCI initiators were the only actor who performed *expositives* and provided primarily felicitous reflective contents regarding problematic situations inquired about in an independent and voluntary manner. They also performed *commisives* and *behavitives* to invoke others' commitment and participation. Data and backing were used for supporting these demonstrative and *commisive* dialogic actions.

Action Domain to Maintain Commitment

The action domain to maintain commitment intends to maintain "visitors" in ongoing

open collective inquiry as "participants" who care. Favorable dialogic actions conveying interest in problems inquired about, willingness to help in the future course of inquiry efforts, and promised sincere undertaking occupied 42 percent of dialogic actions in this action domain. Also, about 27 percent of dialogic actions were behavitives that provided reactions to others' dialogic actions. These actions expressed attitude and emotion toward others' inquiry efforts by acknowledging potential merits and progresses.

Although relatively low in quantity, critical dialogic actions performing the tension between inquiry justification and dis-justification were influential on maintaining commitment. About 11 percent of 471 dialogic actions identified in this action domain were *declaratives* that disapproved the trustworthiness of problems inquired about. On the contrary, about 11 percent of dialogic actions to maintain commitment were *expositives* that counter-argued against the deprecation and dis-justification, restating problems existence and its value for open collective inquiry. Eight percent of them were *directives* that criticized inadequate prior efforts and advised on proper attitudes to generate constructive inquiry.

Contents of action in this action domain were largely inclined with types of *action performed*. About 52 percent of contents of action identified here were felicitous and reflective, conveying positive mutual understanding and support. In detail, among 244 contents of *supportive response giving* identified, 134 were coupled with *commisives*, and 110 with *behavitives*. 42 contents of *compliant response taking* mostly conveyed

felicitous and unreflective acceptance of others' suggestions at the moment by promising sincere undertaking and continued involvement. Action performed for inquiry justification and dis-justification, *declaratives, expositives,* and *directives,* largely provided infelicitous contents. For example, 71 *unsupportive response giving* were associated with *declaratives* and *directives*, 51 and 20 respectively. 52 out of 77 *challenging response taking* were used with *expositives* demonstrating counter-evidences against dis-justifying *declaratives* and *directives*.

Because dialogic actions occurring in this action domain were mainly to develop attitude and commitment, *argumentative components* that were identified for practical reasoning were limitedly used; only sixteen posts out of 80 used any of argumentative component to maintain commitment. These were used mostly for inquiry justification and dis-justification purpose.

In this action domain to maintain commitment, participants conveyed support and commitment using *commisives* and provided felicitous reflective content. Yet, they also exercised critical mind to assess the trustworthiness and the value of problems inquired about for open collective inquiry. Tensions between proponents of initiated open collective inquiry and opponents influenced moves to other action domains.

Action Domain to Guide Inquiry Flow

The action domain to guide inquiry flow was the largest one, comprised of a third of the entire dialogic actions identified. These dialogic actions gave reactions and direction to others' actions and planned future courses of action. Grounding, deflaming, and

coherence were three types of purposes characterizing this action domain. *Behavitives* were predominant, which comprised three quarters of dialogic actions identified in this domain. Grounding, such as name-calling and quotation, was a type of behavitives with which participants could organize dialogue flow. This was a unique feature of asynchronous dialogues in online forums and become a convenient alternative of turn-taking. Because the contents of such quotations reused text of prior statements and their purposes were involved with organizing dialogue flow, these contents were considered as *conversational element*. De-flaming action, such as preemptive excuse and apology, intended to alleviate harmful effect of flaming that delivering harsh and emotionally charged statements.

Participants of open collective inquiry shared an objective of constructing working solutions, and they intended to maintain coherent and focused problem solving. *Directives* and *commisives*, consisting of a quarter of dialogic actions identified in this action domain, were central for this purpose of coherence. *Directives* in this domain assimilated diverse opinions and suggestions, excluded irrelevant contributions, and proposed productive directions. *Commisive* dialogic actions continued to remind of problems and elicited desired contributions. Thus, these dialogic actions carried out felicitous reflective contents such as *assimilating response taking* to converge, whereas provided infelicitous unreflective contents to trim out irrelevant contribution. Since the purpose of this action domain was to guide inquiry flow, argumentative components that were central to practical reasoning were rarely observed here.

In this action domain to manage inquiry process, participants performed behavitives, *directives*, and *commisives* to prevent harmful effects due to flaming, to organize explicit links among dispersed contribution, and to invite desired contribution. Although conversational elements such as quotation, name calling, greeting, appreciation, and excuse were most populated, felicitous reflective contents and infelicitous unreflective contents were crucial to achieve coherence.

Action Domain to Frame a Problem

Problem specification, problem consolidation, and problem diagnosis were the three predominant purposes of the action domain to frame a problem. *Declaratives*, *expositives*, and *declaratives* were predominant here. *Declaratives,* about 25 percent of dialogic actions identified in this action domain, performed for two purposes. First, about 32 percent of these *declaratives* consolidated a problem inquired about initially by confirming that the problem was not a single peculiar case but a common case that necessitated open collective inquiry. These problem-consolidating *declaratives* often supplied additional information about the problem voluntarily, such as *constructive response giving,* and corroborated the trustworthiness of the problem, *challenging response taking*. Second, 68 percent of these *declaratives* diagnosed the problem based on contents of prior dialogic actions. Thus, these actions performed provided felicitous reflective contents of diagnosis, yet such diagnoses were likely put in question through infelicitous reflective contents, such as *confused response giving.*

The rest of actions performed in this action domain were *expositives* and *directives* that were paired to collect more information on a problem inquired about, 40 percent and 35

percent respectively. *Directives* requested further details to the hearer and directed what to do to generate better information to frame a problem. *Expositives* provided additional problem details and requested information in response to such *directives*. *Directives* were motivated toward resolving uncertainty and ambiguity in understanding a problem inquired about. Thus, such *directives* dialogic actions were accompanied with infelicitous reflective content, such as *confused response giving,* only. To the contrary, *expositives* responded to *directives* either by following the direction or refusing it. The former provided felicitous unreflective content, such as providing *constructive response giving,* whereas the latter demonstrated infelicitous unreflective content, such as *unsupportive response giving*.

Dialogic actions performed in this action domain aimed to build up a shared image of problems from segmented and distributed problem information and frame it in search of working solutions. Thus, data was the most preferred argumentative component that provided other participants opportunities to investigate problems inquired about from an unbiased stance. Utterers copied and pasted code sets in body text or attached source code files and snapshots of errors. *Directives* and *declaratives* used such argumentative components as backing, personal and general warrant, and qualifiers to corroborate an utterer's request for further actions.

In this action domain to frame a problem, participants performed *directives* and *expositives* to specify a problem and consolidate it with additional details. They also assessed contents of prior dialogic actions in a reflective manner to diagnose problem causes. Here, data was most frequently used *argumentative component*.

Action Domain to Negotiate Solutions

Suggesting hypothetical solutions and validating them were the two purposes of the action domain to negotiate solutions. 28 percent of the dialogic actions identified in the present study belonged to this action domain. Participants directed others to carry out their hypothetical solutions and, if requested or preemptively, further explained the suggestions for better understanding. About 40 percent of the dialogic actions identified in this action domain were *directives,* either providing hypothetical solutions or requesting further explanation. 36 percent of the dialogic actions were *expositives.* About 52 percent of these *expositives* demonstrated additional information and explanation regarding hypothetical solutions.

The rest of the *expositives* provided counterevidence to validate hypothetical solutions and contradict opinions in prior dialogic actions. Although negative evaluation regarding the validity was already implicated, such *expositives* focused more on demonstrating counter evidences than dismissing further negotiation. For such judgmental dialogic actions, explicitly seeking for the trustworthiness and relevance, participants performed *declaratives*, consisting of 19 percent of dialogic actions identified in this action domain. These dialogic actions either denounced or supported what was indicated by prior dialogic actions.

In negotiating solutions, participants entertained diverse types of contents of action. For example, they suggested hypothetical solutions either in direct response to problem statements by providing felicitous unreflective content, *constructive response giving*.

They alternately supported existing solutions under negotiation by corroborating them with felicitous reflective content, *supportive response giving.* They attempted to overcome inadequate understanding of suggested solutions and discrepant opinions by exchanging infelicitous reflective contents, *confused response giving and challenging response taking,* and felicitous (un)reflective content, *constructive response giving and supportive response giving.* They also denounced some suggestions to exclude them from negotiation by delivering infelicitous unreflective content, *unsupportive response giving and declining response taking.*

This action domain was involved with a broader spectrum of *argumentative components* because suggestions and validations were essentially associated with substantive reasoning. 64 percent of dialogic actions that used *argumentative components* took place in this action domain. Backing in this domain was not only used for supporting the reliability of suggestions and validations but also was provided as an independent unit of hypothetical solution or additional information; an utterer provided only direct links in place of his suggestions instead of paraphrasing and explaining them. Data was also a form of representing suggestions when unbiased presentation of direct evidence was crucial.

In this action domain to negotiate solutions, participants were dominantly engaged in performing *directives*, *expositives*, and *declaratives.* They utilized various types of contents of action and argumentative components to consolidate the plausibility and trustworthiness of hypothetical solutions and compete with other hypothetical solutions

validation.

Action Domain to Confirm Workability

In the action domain to confirm workability, participants exchanged outcomes of experimenting with *negotiated* hypothetical solutions and afterthoughts on the experimentation to achieve better sense making and workability. After they settled down with a working solution, OIC initiators post-produced it as collective knowledge for future use. However, only 29 out of 80 achieved such full closure. Participants in this action domain primarily preformed *expositives,* 72 percent of dialogic actions identified in this action domain, to demonstrate their experimentation and its outcome. When the outcome was not fully satisfactory, they shared it using *expositives* and elicited others' expertise using *directives* to achieve better workability. When a satisfactory outcome was achieved, they performed *expositives* to make it available to others by presenting summary of such solutions.

Since participants intended to demonstrate experimentation processes and outcomes, the degree of felicity and reflection differed depending on the outcomes. When experimenters obtained certain success, they carried out felicitous reflective content, *assimilating response taking.* Otherwise, they continued open collective inquiry to improve the situation by providing infelicitous reflective content, *challenging response taking*, to identify potential sources of failure or by infelicitous unreflective content, *declining response taking*, to rule out any irrelevance. As this action domain primarily aimed to present experimentation and its outcome, participants used data primarily to support their dialogic actions.

To recap, I presented findings that could explain open collective inquiry processes in online forums in this chapter. I identified six action domains that constituted open collective inquiry based on participants' distinct purposes of dialogic actions. I further analyzed how participants performed such purposes using three dimensions of dialogic action. Participants' proper performance of these dialogic actions in each action domain was crucial to achieve effective open collective inquiry.

Chapter 5. Findings – Part II

In this chapter, I present findings that could address the second research question: What characteristics of dialogic actions influence outcome of open collective inquiry (OCI) in online forums? I identified three aspects of dialogic actions for open collective inquiry — fulfillment of essential dialogic actions in each action domain, OCI initiators' roles, and open collective inquiry context. I investigate how these three characteristics were related with open collective inquiry outcomes with distinct types of closure — full closure, partial closure, non-closure, and degraded closure. Based on the findings, I present a theoretical model of open collective inquiry.

5.1. Fulfillment of Essential Dialogic Actions

In characterizing open collective inquiry processes using participants' dialogic actions, I identified types of essential dialogic actions that needed to be fulfilled adequately in each action domain (See Table 14). For example, *declaratives*, *expositives*, and *directives* were essential types of *action performed* in the action domain to frame a problem. *Constructive response giving* and *confused response giving* were two predominant types of *content of action*. These dialogic actions were essential to perform the three purposes of this action domain to frame a problem: specification, consolidation, and diagnosis. In addition, the illustrative cases that I used for describing open collective inquiry processes demonstrated that relevant and adequate performance in each action domain were the crucial for a open collective inquiry dialogue to be effective (See Table 9). For example, I identified ten dialogic actions in the action domain to initiate inquiry from Thread 1 among which five dialogic actions were used for problem demonstration.

The five dialogic actions performed *expositives* using four contents of *constructive response giving* and one of *unsupportive response giving*. These five dialogic actions used 29 lines out of 38 in the initial posting along with two units of *argumentative component*. Compared to Thread 1, Thread 2 used three lines along with one unit of *argumentative component*, Thread 3 used five lines, and Thread 4 did two. As such, I conjecture that that fulfillment of such essential dialogic actions would have a positive relation with open collective inquiry outcomes.

I am not favorable to using "a number of lines" as a measurement of knowledge contribution because such quantitative measure could not adequately consider qualitative distinction. For example, a discussion thread from Forum A had 32 replies from five participants. However, like Thread 4 in the previous section, 23 replies came out of an OCI initiator who only grizzled for a prompt contribution of a ready-made working solution without exercising any effort to address others' requests to solve his problem. For example, such replies like "Wow, no replies (#2)"*or* "Ok so I will beg. If someone could please help with this issue I would appreciate it (#6)" did not contain any constructive content. In another discussion thread that also had 32 replies composed with 381 lines of text did not generate a working solution, an agreeable conclusion in this opinionating case, due to harmful flaming. Many of lines of text were used for denouncing others statements and arguing against such denouncements without collaborating on solving a problem inquired about initially. To the contrary, open collective inquiry dialogue that generated a working solution did not necessarily need many lines. For example, a discussion thread that had 16 replies from seven participants

had 208 lines of text focusing on constructing solutions and validating the workability of the solutions.

However, in this analysis, the categories of essential dialogic actions and their presence in each action domain provide significant qualitative distinctions. Thus, I believe that an average number of lines used for each type of essential dialogic action become a reasonable indicator of the "fulfillment." For example, the four illustrative cases in Section 4.1.2 support this idea; effective open collective inquiry dialogues demonstrated adequate fulfillment in most of action domains, but ineffective open collective inquiry dialogues did not. In this way, however many number of replies was contributed or however many lines were used to perform a dialogic action, such dialogic actions need to be used for addressing what matter to an ongoing open collective inquiry in a constructive manner.

I present the average count of such essential dialogic actions of each action domain and their average number of lines in Table 15. Among 80 discussion threads studied in the present study, 29 were identified as full closure, 16 were partial closure, 30 were non-closure, and 5 were degraded closure. From the 29 discussion threads with full closure, I identified 2,217 dialogic actions and counted 7,679 lines of text. On average, each dialogue used 264.8 lines of text to derive a working solution with adequate understanding. I identified 1131 dialogic actions from 16 discussion threads with partial closure and counted 3,709 lines of text. On average, 231.8 lines of text were used in each open collective inquiry dialogue. From 30 discussion threads that did not show a

clear indication of problem solving, I derived 1757 dialogic actions and counted 4,445 lines of text. The average lines of text used in each of such open collective inquiry dialogues dropped to 148.2. Finally, the five degraded open collective inquiry dialogues were analyzed into 413 dialogic actions and 1,632 lines of text. On average, they used 324.6 lines of text. I did not include them in Table 15 because I identified *argumentative components* as their occurrence in each reply. However, the occurrence of such *argumentative components* is presented in Appendix F, and I refer to it while I discuss the relation between fulfillment of essential dialogic action and open collective inquiry outcome.

In the action domain to initiate inquiry, fully closed open collective inquiry dialogues and partially closed ones demonstrated a similar extent of fulfillment. Fully closed ones performed 2.5 *expositives* using 10.7 lines of text in demonstrating problem. They used 3.6 *constructive response giving* using 11.7 lines of text. 13 out of 29 also provided one or more units of data in describing problem symptom. Partially closed ones performed 2.8 *expositives* using 12.3 lines of text. They performed 3.9 *constructive response giving* using 11.4 lines of text. Nine out of 16 also presented data to support the problem description. Non-closed one performed a similar number of *expositive* to demonstrate a problem but used less lines — 8.3 lines of text. They also used less lines of text in performing *constructive response giving*. 13 out of 30 provided data to describe problems. Interestingly, degraded ones performed 2.2 *expositives* using 16.2 lines of text. They performed four *constructive response giving* using 20 lines. Overall, except non-closed OCI, the others demonstrated equivalent fulfillment here.

Table 15. Fulfillment of Essential Dialogic Actions in Action Domains

Action domains	Action performed								Content of action							
	Closure type	Full (29)		Partial (16)		Non (30)		Degraded (5)		Closure type	Full (29)		Partial (16)		Non (30)		Degraded (5)	
	Classes	ct.	line	ct.	line	ct.	line	ct.	line	Classes	ct.	line	ct.	line	ct.	line	ct.	line
To initiate inquiry	Expositive	2.5	10.7	2.8	12.3	2.6	8.3	2.2	16.2	Constructive	3.6	11.7	3.9	11.4	3.6	8.8	4	20
	Commisive	1.6	2.7	2.1	4.1	1.5	2.3	2.4	5	Unsupportive	0.4	1.5	0.6	4.2	0.4	1.6	0.2	0.8
To maintain commitment	Declarative	0.5	0.9	1.0	3.3	0.6	1.5	0.2	1.2	Supportive	3.8	6.9	3.1	5.8	2.4	3.8	2	3.4
	Expositive	0.6	2.5	0.8	3.8	0.5	1.2	1.4	4.4	Unsupportive	0.6	1.1	1.4	4.5	0.8	1.5	1.6	4.2
	Commisive	2.7	4.4	2.4	4.2	2.5	3.8	2.6	5.6	Challenging	0.8	11.0	1.3	4.6	0.9	1.9	2	6.4
To guide inquiry process	Directive	2.4	9.1	2.9	9.8	1.8	4.0	4.4	20.4	Assimilating	2.6	11.5	1.4	4.9	1.3	3.1	1.8	6.2
	Commisive	3.0	11.9	2.9	8.5	2.1	5.3	1.6	4.2	Challenging	2.5	8.5	3.6	9.8	2.6	4.4	1.8	13.8
	Behavitive	20.6	28.8	16.4	23.4	14.6	17.7	22.8	45.4	Conversational	19.7	25.6	15.5	20.4	14.3	17.3	18.2	7.2
To frame a problem	Declarative	3.1	13.6	3.8	16.1	2.6	7.8	1.2	8.4	Constructive	6.1	26.0	7.8	39.7	5.9	18.6	3.6	15.8
	Expositive	4.5	19.8	6.4	35.9	4.4	14.5	3.2	13.2	Confused	4.3	10.5	4.2	11.8	4.4	12.5	3	8.2
	Directive	4.3	10.5	3.8	11.1	4.2	12.3	3.0	8.2									
To negotiate solutions	Declarative	4.6	22.6	3.6	13.4	2.5	6.5	5.4	26.6	Constructive	7.8	52.1	7.0	37.0	5.5	26.9	10.6	58
	Expositive	8.5	55.8	6.0	31.5	4.5	18.5	14.2	84.4	Supportive	2.2	10.5	1.6	5.5	1.7	5.5	2.8	18.6
	Directive	7.9	42.6	7.0	30.4	7.1	30.2	10.2	51	Assimilating	1.5	11.7	0.4	0.8	0.3	1.4	1.6	5.2
										Unsupportive	2.9	12.1	3.2	10.0	1.6	4.7	4.4	20.4
										Declining	2.6	16.9	2.5	14.3	1.5	3.9	5.4	40.4
										Challenging	3.0	12.6	2.1	7.9	2.2	7.9	3.2	16.8
To confirm workability	Declarative	0.8	2.7	0.3	0.5	0.1	0.2	0	0	Assimilating	2.4	10.9	1.7	5.6	0.3	0.8	0	0
	Expositive	3.4	14.1	2.6	11.4	2.2	5.7	2.2	12.6	Declining	0.8	2.6	0.9	2.8	1.5	5.2	1.8	11.6
	Directive	1.0	3.7	0.5	1.6	0.8	1.7	0.2	0.2	Challenging	1.3	5.4	0.7	4.9	0.5	1.2	0.4	1
Average per discussion		76.4	264.8	70.7	231.8	58.6	148.2	82.6	324.6		76.4	264.8	70.7	231.8	58.6	148.2	82.6	324.6

In the action domain to maintain commitment, all four categories of open collective inquiry dialogues fulfilled *commisives* at the similar extent in conveying support and commitment. Regarding inquiry justification and dis-justification, a half of fully closed open collective inquiry dialogues performed *declaratives* to dis-justify problems inquired about and *expositives* to demonstrate evidences to inquiry justification using 2.5. Similarly, partially closed ones performed *declaratives* using 3.3 lines of text and *expositives* using 3.8 lines of texts. A half of non-closed ones performed *declaratives* using 1.5 lines of text and *expositives* using 1.2 lines of text. Whereas a fifth of degraded one performed *declaratives* using 1.2 lines for inquiry justification, 1.4 performed *expositives* using 4.4.

Fully closed ones performed 3.8 *supportive response giving* using 6.9 lines of text, and partially closed ones did 3.1 *supportive response giving* using 5.8 lines of text. In contrast, non-closed ones performed 2.4 *constructive response giving* using 3.8 lines of text, and degraded ones did two *supportive response giving* using 3.4 lines of text. In a similar vein, degraded ones fulfilled 1.6 *unsupportive response giving* using 4.2 lines of text. Partially closed ones performed 1.4 *unsupportive response giving* composed with 4.5 lines of text. Interestingly, about 80% of fully closed ones performed *challenging response taking* using 11 lines of text, and degraded ones performed two *challenging response taking* using 6.4 lines of text. Overall, fully closed ones performed more supportive dialogic actions and conveyed a less tension between inquiry dis-justification and justification. Non-closed ones fulfilled supportive actions poorly and did not convey much tension of inquiry justification. Partially closed ones and degraded ones were most actively in

fulfilling the tension between inquiry dis-justification and inquiry justification given the number of lines used for *expositives* and *unsupportive response giving*.

In the action domain to guide inquiry flow process, fully closed open collective inquiry dialogues and performed 2.4 *directives* using 9.1 lines of text, and partially closed ones did 2.9 *directives* using 9.8 lines. Non-closed ones fulfilled only 1.8 *directives* using 4.0 lines of text. The fulfillment of *commisives* and behavitives demonstrated a similar pattern with that of *directives*. In a similar vein, fully closed one fulfilled *challenging response taking* the most: 2.6 actions in 11.5 lines. Partially closed one performed 1.4 *challenging response taking* using 4.9 lines of text, non-closed one 1.3 *challenging response taking* in 3.1 lines of text. The similar contrast was observed in fulfilling *challenging response taking* and *conversational element*. Degraded ones showed a bit outlying pattern from this patter. They performed 4.4 *directives* using 20.4 lines of text, but fulfilled the least *commisives*: degraded one did 1.8 *challenging response taking* in 6.2 lines of text. They fulfilled *assimilating response taking* more than partially closed ones and *challenging response taking* more than fully closed one. Overall, effective open collective inquiry dialogues tended to fulfill more dialogic actions that organizing inquiry progress and dialogue flow than non-effective ones. Degraded ones were actively fulfilling such dialogic actions but failed overcoming inadequate *commisive* actions.

In the action domain to frame a problem, fully closed ones performed 3.1 *declaratives* using 13.6 lines of text, and partially closed ones fulfilled 3.8 *declaratives* in 16.1 lines of text. Less effective ones fulfilled less *declaratives*; non-closed ones did 2.6 *declaratives*

in 7.8 lines of text, and degraded ones did 1.2 *declaratives* using 8.4 lines of text. Given that *declaratives* in this action domain intended to support the trustworthiness of problem occurrence, ineffective open collective inquiry dialogues poorly fulfilled this essential dialogic action. Non closed ones fulfilled 4.2 *directives* that requested for further information using 12.3 lines of text and 4.4 *expositives* that provided requested information. Fully closed ones fulfilled 4.3 *directives* in 10.5 lines of text and 4.5 *expositives* in 19.8 lines of text. Partially closed ones performed 3.8 *directives* in 11.1 lines of text and 6.4 *expositives* in 35.9 lines of text. However, degraded ones fulfilled three *directives* using in 8.2 lines.

Content of action demonstrated a similar pattern with *action performed*. Partially closed ones performed 7.8 *constructive response giving* using 39.7 lines of text to address 4.2 *confused response giving* in 11.8 lines of text. Fully closed ones performed 6.1 *constructive response giving* using 26 lines of text and 4.3 *confused response giving* in 10.5. In contracts, non-closed ones fulfilled 5.9 *constructive response giving* using 18.6 lines of text and 4.4 *confused response giving* using 12.5. Degraded ones performed 3.6 *constructive response giving* using 15.8 lines of text and three *confused response giving* using 8.2 lines of text. Data was the most essential element in this action domain to frame a problem. Partially closed ones used 49 units of data, fully closed ones did 33 units, non-closed one used 38, and degraded ones used only three. However, fully closed ones also used 12 units of backing and 11 units of personal warrant, compared with partially closed ones using four units of backing and five units of personal warrant and with non-closed ones using 10 units of backing and eight units of personal warrant. In general, effective

open collective inquiry dialogues fulfilled more than ineffective ones. Degraded ones performed particularly poorly in this action domain, which implied that inadequate and vague problem framing was likely to result in heated dispute over the relevance and the validity of contribution. Also, the pattern in *argumentative component* explains why partially closed ones demonstrated better fulfillment than fully closed one but did not achieved better performance; that is, fully closed ones used more diverse sources of statement instead of putting direct problem observation, e.g., data.

In the action domain to negotiate solutions, fully closed open collective inquiry outperformed the other three categories. They performed 7.9 *directives* providing hypothetical solutions in 42.6 lines of text, 8.5 *expositives* providing supportive or contradictory materials using 55.8 lines of text, and 4.6 *declaratives* assessing contributions in 22.6 lines of text. Partially closed one fulfilled seven *directives* suing 30.4 lines of text, and six *expositives* 31.5 lines of text, and 3.6 *declaratives* in 13.4 lines of text. Non closed ones fulfilled 7.1 *directives* in 30.2 lines of text, 4.5 *expositives* in18.5 lines of text, and 2.5 *declaratives* in 6.5 lines text. That is, partially closed ones fulfilled less in assessing suggestions provided, and non-closed ones fulfilled less dialogic actions for validating suggestions. To the contrary, degraded ones performed 10.2 *directives* using 51 lines of text but 5.4 *declaratives* using 26.6 lines of text and 14.2 *expositives* in 84.4 lines of text. This indicated that degraded ones focused more on assessing and validating hypothetical solutions suggested.

Fully closed ones fulfilled 7.8 *constructive response giving* using 52.1 lines of text and

2.2 *supportive response giving* in 10.5 lines of text. At the same time, they also fulfilled negative dialogic actions, such as 2.9 *unsupportive response giving* in 12.1 lines of text, 2.6 *declining response taking*, and three *challenging response taking* in 12.6 lines of text. Partially closed ones performed less constructive and *supportive response giving* than fully closed ones: seven *constructive response giving* in 37 lines of text and 1.6 *supportive response giving* in 5.5 lines. However, they performed more criticizing dialogic actions: 3.2 *unsupportive response giving* in 10 lines of text, 2.5 *declining response taking* using 14.3 lines of text, and 2.1 *challenging response taking* in 7.9 lines of text. Similar patterns were observed in non-closed ones and degraded ones. In particular, degraded ones fulfilled *unsupportive response giving*, *declining response taking*, and *challenging response taking* most actively.

Regarding *argumentative components*, fully closed open collective inquiry dialogues used various *argumentative components* heavily; they use 2.4 units of backing, one unit of data, and 2.4 units of personal warrant, and 2.6 units of general warrant. Compared with this, partially closed ones and non-closed ones used about a half of argumentation components that fully closed ones used. What is more interesting is that degraded ones used *argumentative components* most heavily: 5.7 units of backing, 1.7 units of data, 3.7 units of personal warrant, and 9.3 units of general warrant. This implies that degraded open collective inquiry dialogues tended to relying more on abstract knowledge to debates over the validity and trustworthiness of other statements than on concrete experience-based knowledge. In that way, effective open collective inquiry dialogues fulfilled positive and productive dialogic actions more in constructing solutions, whereas

ineffective open collective inquiry dialogues fulfilled more of negative and unsupportive dialogic actions.

The action domain to confirm workability was most active in fully closed open collective inquiry dialogues because these dialogues could extend workability and post-produce derived working solutions while other types of dialogues were limited in performing such actions. Fully closed open collective inquiry dialogues fulfilled 3.4 *expositives* that intended to demonstrate outcomes of experimenting hypothetical solutions, using 14.1 lines of text. These dialogues also fulfilled one *directive* that requests explanations or extends prior inquiry for better workability in 3.7 lines of text. They also performed 0.8 *declarative* to assess the workability using 2.7 lines of text. Although partially closed ones, non-closed ones, and degraded ones fulfilled *expositives* to certain extent, they performed inadequately *declaratives* and *directives*. In line with such fulfillment patterns of *action performed*, fully closed open collective inquiry dialogues fulfilled 2.4 *assimilating response taking* that interpret prior actions to generate an incorporative conclusion using 10.9 lines of text. They also performed 1.3 *challenging response taking* that attempt to overcome limitations of prior actions using 5.4 lines of text. Partially closed ones performed 0.7 *challenging response taking* using 4.9 lines of text but performed 1.7 assimilating response giving using 5.6 lines of text. To the contrary, non-closed ones performed such essential dialogic actions poorly, whereas they performed 1.5 *declining response taking* in 5.2 lines of text. Similarly, degraded ones heavily performed 1.8 *declining response taking* using 11.6 lines of text without many actions for other dialogic actions.

Overall counts of essential dialogic actions and lines of text used for such actions were largest in fully closed open collective inquiry dialogues and decreased from partially closed ones, non-closed ones, and degraded ones, respectively. This is because the more an open collective inquiry dialogue proceeds toward a complete working solution; the more dialogic actions are needed. For example, fully closed ones performed more actions in the action domain to validate the workability of hypothetical solutions and to post-produce derived solutions. However, in fulfillment patterns of essential dialogic actions demonstrated qualitative distinctions among the four categories of open collective inquiry dialogues. Fully closed open collective inquiry dialogues fulfilled essential dialogic actions in all action domains. These dialogues also performed more *constructive response giving* and *assimilating response taking* than other categories. Partially closed dialogues fulfilled essential dialogic actions to a similar extent with fully closed ones. However, they fulfilled less essential dialogic actions in the action domains to negotiate solutions and to confirm workability. In these action domains they tended to perform more *declining response taking* than fully closed ones. Fulfillment of non-closed ones was low in almost every action domains. Degraded ones performed poorly in the action domains to manage inquiry process and to frame a problem but most actively in the action domains to negotiate solutions and to confirm workability. They performed *declining response taking* and *unsupportive response giving* most heavily in those action domains.

5.2. Types of OCI Initiator' Role

Given these findings regarding the relation between fulfillment of essential dialogic actions in each action domain and outcomes of open collective inquiry, I became to

question about what could influence such distinct fulfillment patterns. The illustrative cases indicated that how OCI initiators behave could affect open collective inquiry outcomes. For example, the OCI initiator of Thread 1initiated his inquiry with detailed problem description and attended all action domains; he responded all requests for additional information and further explanation, organized the inquiry progress incorporating disperse contributions, and avoided unnecessary dispute. The OCI initiator of Thread 2 fulfilled dialogic actions to describe problems adequately and attempted to extend the workability of a derived solution. However, he failed to get other's support for such extended inquiry. The OCI initiator of Thread 3 did not get involved in collaboration with others. He tended to assess the plausibility of hypothetical solutions suggested rather than undertaking such suggestions to validate their workability through actual experimentation. The OCI initiator of Thread 4 only posed his problematic situation but did not performed adequate dialogic actions to resolve excessive disputes. Thus, I attempted to characterize OCI initiators of all discussion threads studied in the present study into five types of actor based on their dialogic actions: coordinator, principle investigator, experiment proxy, solution taker, and bystander. I present the distribution of distinct types of OCI initiators in the three forums sampled in Table 16. I also compared the number of original actors' dialogic actions and the number of other participants' dialogic action in each category. I present a detailed distribution of each actor type's dialogic actions in Table 17. The table shows the average number of dialogic actions performed in dimensions of action domains, *action performed*, *content of action*, and *argumentative component*. I marked top three categories in each dimension of dialogic action.

Table 16. Dialogic Actions Given by OCI initiators and Dialogic Actions Received

	N of Dialogues			OP's Dialogic Actions				Others' Dialogic Action			
OP's roles	**A**	**B**	**C**	**Total**	**A**	**B**	**C**	**Total**	**A**	**B**	**C**
Principle investigator	15	14	10	1382	695	339	348	1562	917	414	231
Coordinator	9	1	-	291	227	64	-	583	525	58	-
Experiment proxy	3	1	4	213	101	13	99	239	92	40	107
Solution taker	8	1	6	501	259	88	154	427	223	40	164
Bystander	5	3	-	72	50	22	-	302	174	128	-
Sum	40	20	20	2459	1332	526	601	3133	1931	680	502

The type of **Principle investigator** was most common in all three forums: 15 from Forum A, 14 from Forum B, and 10 from Forum C. This type of OCI initiators was willing to exercise their ownership of the open collective inquiry that they initiated. Thus, they attended to their open collective inquiry in all action domains consistently; they initiated an inquiry with as much problem description as possible, followed it up with more details on request and voluntarily, shared their findings, incorporated dispersed opinions and solution, and worked hard to generate a working solution. Thanks to these diverse types of dialogic actions, they performed the most number of dialogic actions and received a comparable number of others' dialogic actions in return: OCI initiators in this category performed 1,382 dialogic actions and drew 1,562 dialogic actions from other participants.

Table 17. Dialogic Actions Performed by Distinct OCI Initiator Role Types and Other Participants' Dialogic Actions

	Action Domains						Action performed						Content of action						Argumentative component					
		Actor types						Actor types						Actor types						Actor types					
	Classes	PI	CRD	EP	ST	BS	Classes	PI	CRD	EP	ST	BS	Classes	PI	CRD	EP	ST	BS	Classes	PI	CRD	EP	ST	BS
OCI initiators' Dialogic Actions	To initiate	6.1	5.3	5.4	6.1	5.3	Declaratives	2.1	3.2	1.6	1.9	0.3	Constructive	9.3	5.2	8.8	7	4.9	Backing	0.56	0.6	0.3	0.5	0.3
	To commit	2.4	2.1	1.6	1.8	0.5	Expositives	12	6.1	9.8	9.8	3.9	Compliant	0.6	0.4	0.1	0.7	0	Data	3.1	0.9	2.1	1.7	0.9
	To guide	13	11	8	13	1.1	Directives	4	4.3	2.5	4.4	0.6	Supportive	2.1	2.8	1.1	1.6	0.6	P-warrant	0.23	0.4	0.3	0.2	0.0
	To frame	5.2	2	5.9	3.7	1.3	Commisives	6.4	5.9	5.6	7.3	2.5	Assimilating	3.7	2.9	0.3	0.9	0.4	G-warrant	0.15	0.1	0.1	0.0	0.1
	To negotiate	5.4	7.8	3.4	6.1	0.6	Behavitives	11	9.6	7.1	10	1.8	Confused	0.8	0.4	1.5	0.9	0.3	Qualifier	0.13	0.1	0.0	0.0	0.3
	To confirm	3.3	0.7	2.4	3.3	0.3							Challenging	4.9	5.1	3.6	6.5	0.4						
													Unsupportive	1.6	1.5	0.4	1.3	0.3						
													Declining	1.7	1.9	2.8	3.2	0.4						
													Conversation	11	8.9	8.1	12	1.9						
Other participants' dialogic Actions	To commit	4.8	3.2	2.6	2.8	3.4	Declaratives	4.9	4.5	2.8	2.3	4.4	Constructive	9.3	13	6	7.7	8.5	Backing	1.97	4.6	0.8	2.0	2.0
	To guide	12	20	8.9	6.7	13	Expositives	7	18	4.1	4.5	9.4	Compliant	0.3	0.4	0	0.3	0.6	Data	1.79	1	0.8	1.5	1.9
	To frame	6.2	2.6	7.4	4.9	7	Directives	12	12	12	12	7.8	Supportive	4.4	5.6	2	1.9	3.6	P-warrant	1.41	6	0.1	1.4	1.3
	To negotiate	15	32	9.3	13	14	Commisives	4.6	5.6	2.3	1.8	5.5	Assimilating	2.1	4.1	0.8	0.5	1.9	G-warrant	1.95	7.4	1.0	1.2	3.4
	To confirm	1.7	1.1	1.8	0.4	0.5	Behavitives	12	18	8.8	7.2	11	Confused	4.7	1.6	7.8	5.1	2.5	Qualifier	0.74	1	0.5	0.5	1.5
													Challenging	5.3	6.4	3.4	3.3	5.4						
													Unsupportive	3.4	7.4	0.8	2.9	3.4						
													Declining	1.6	6.5	1	0.7	2.9						
													Conversation	8.9	13	8.3	5.9	9						

In addition to a well-composed original posting to initiate inquiry, OCI initiators in this category of principle investigator performed several common dialogic actions. They could effectively retain others' attentions to their ongoing inquiry progress. These OCI initiators respond to others' contributions as promptly as possible. If they could not undertake them, they convey their commitment to such suggestions (See the first quotation below). These principle investigators did not simply depend on others and expect them to contribute a working solution. In a sense, the open collective inquiry that they initiated openly in online forums was a part of their effort. They often parallel their own inquiry to the open inquiry. Thus, they could update outcomes and progress of such effort as well. They were also willing to provide additional problem-related information without others' requests (See the second and third quotations below).

> I'll be sure and test your modified source later this evening on a 2.6.24.4 kernel and see what I can come up with. (L4-#8) – Action domain to maintain commitment: commisive: compliant response taking
>
> The last thing I did wasn't a "tweak". I'd like to maintain a browser history, but not a long one.… Now the delay between typing a URL and seeing it actually appear in the URL bar is gone. That's nice. The tweaks definitely seem to be helping. (L11-#16) – Action domain to manage inquiry process: commisive: assimilating response taking
>
> Because it happens with everybody that sometime it is working sometime it is not. in this step i have called a standard method of a standard business object which updates movein date in a switch document. (A19-#5) – Action domain to frame a problem: expositive: constructive response giving

In accepting others' suggestions, these OCI initiators were careful about assessing the validity of such contributions. When they were unsure of the validity, they tended to illustrate reasons and ground of their assessment instead of declining outright. The two quotations below exemplify this point. Compared with the second quotation that simply rejected other's suggestion, the first quotation showed how an OCI initiator cautiously

declined other's suggestion explaining her doubt based on a particular reference.

> I wish I had given more thought to the question before I presented it. A Wikipedia chart shows: Pentium II wattage as 18.8 thru 43.0 depending on model. Pentium III's run 25.3 - 34.5. Pentium IV's run as high as 115 watts. The lowest wattage Celeron seems to be 11.2 while wattage of the Celeron in one of my computers is 84. I found a low of .65 watts for the Atom. Then I read that MSI motherboards generally consume less power than ASUS boards, and it became apparent that the answer to my question, if there is one, is not so simple a matter. (L18-#8) – Action domain to construct solution: declarative: challenging response taking: backing
>
> I know how to read Work Flow Container values. (S20-#6) – Action domain to construct solution: declarative: declining response taking

When OCI initiators of this category derived a working solution, they tended to rationalize about how it work and to overcome limitations, if any. The quotation below exemplified such attempt in the action domain to confirm workability.

> I solved the problem myself. I dont know if this is the best solution.
> Let me know if you guys have better solution.
> Due to some reason I was never able successfully transfer binding elements from Standard Task to subtype method. So I have used to SWE_WI_GET_FROM_ REQUESTER to get Workitem ID and SWI_READ_CONTAINER_ELEMENT to read the individual element values based on Workitem. (S20-#15) – Action domain to confirm workability: declarative, directive, and expositive: challenging response taking

The distribution of dialogic actions presented in Table 16 also supports these characteristics. These principle investors demonstrated the most active performance in all action domains. Dialogic actions of these principle investigators in the action domains to frame a problem was only second to those of experiment proxies who were characterized for delivering requested problem-related information. Their dialogic actions in the action domain to negotiate solutions were less than those of coordinators' and solutions takers'. Given that coordinators were tended to discuss and validate opinions and suggestions, and that solution takers behaved selective on assessing suggestions, principle investigators' dialogic actions in this domain were most meaning for moving forward to experimentation in the next action domain. In line with their constrictive and

self-motivated orientation, they were outstanding in performing *expositives* and *commisives* using *constructive response giving*, *assimilating response taking*, and *challenging response taking*, while they also performed significant amount of *declaratives*, *directives*, and behavitives. They also utilized various *argumentative components* to support their dialogic actions.

The type of **coordinator** was similar to principle investigator in terms of its active involvement and motivation. The two types only differ in types of topic that they inquired about. Whereas principle investigators dealt with actual problematic situations and searched for working knowledge, coordinators did with abstract issues without actual problem on hand and aimed to reach an agreeable conclusion. Thus, their performance in the action domains to frame a problem and to confirm workability was in active. I identified nine OCI initiators in this category from Forum A and one from Forum B. This indicates that open source forum was more open to such type of discussion than the other two. Since these OCI initiators intended to hear others' opinions primarily, the number of other participants' dialogic actions doubled that of OCI initiators.

Due to the theoretical and abstract nature of problems inquired about, their collective inquiries were likely to be populated with various opinions and argumentation over the validity of such opinions. Thus, they performed dialogic actions heavily in the action domain to manage inquiry progress in order to organize discussions and arguments in a coherent manner. For example, in the quotation below, an OCI initiator restated her inquiry objective to ensure relevant contribution, as other participants began to discuss

things that were not helpful for her objective.

> As I wrote, my project is to make a low power computer dedicated to web surfing with Firefox being the only installed application along with the JWM window manager. It will run in memory with no hard drive, cd rom, or floppy. After several hours searching Google and Ebay: (L18-#18) — Action domain to manage inquiry progress: directive: challenging response taking

These coordinators got involved heavily in validating suggested opinions in the action domain to negotiate solutions. Here, they assessed, supported, contradicted, or denounced the trustworthiness and the validity of suggestions. In doing so, these OCI initiators organized others' suggestions and developed own understanding. For example, the quotation below is the last reply made by an OCI initiator. An OCI initiator put partial quotations of others' statements dispersedly made in this last reply and demonstrated how such contribution addressed her inquiry objective adequately.

> Quote:
> Originally Posted by **A**
> The DDR2-1066 is basically an over clocked DDR2-800. DDR2-800 is the highest rating from JEDEC. DDR2-1066 is not a JEDEC spec...
> Quote: Originally Posted by **B**
> For most applications, especially with an L2 cache of at least 1MB, I expect you are right that you won't see a meaningful performance increase going above 800 in DDR2 ram.
>
> Huh! well, I think I'll reconsider the RAM.
>
> Quote: Originally Posted by **B**
> I'm pretty sure "CPU" in the post you quoted was a mistake and he meant "PSU". Maybe you do as well. If I recall correctly, you prefer case and PSU purchased separately.
>
> That's what I thought also, which seems to match what everyone's been saying (including many reviews I've read on newegg itself.)
>
> Quote: Originally Posted by **B**
> Buy a drive with a lot more capacity than you need. The average seek time will be lower because you will have better disk locality as a function of total disk size. The average transfer rates are also higher. Only rotational latency is not improved.
>
> Whoa! I didn't realize that. It makes sense that the data at the outer edges of the

> platters will be moving with a higher linear speed than the rest (although not angular, like you said),
> but I had never thought about how that would actually affect things. And somewhere in the chain of command, the system will actually take advantage of that fact intentionally? That's very interesting.
>
> Quote: Originally Posted by **C**
> Check out the Antec sonata, 500W CPU (made by Enermax actually) and one of the quietest, coolest and sturdiest cases a hundred dollars will buy you (I deny having Antec shares ;D). I really don't think you'll need more than 500W for your purposes.
>
> Thanks for the recommendation! I'll have a look at it. — Action domain to manage inquiry progress: directive: challenging response taking

In this way, OCI initiators of this type performed *declaratives*, *directives*, and *commisives* most frequently. They performed *expositives* to a significant extent, but these dialogic actions were more oriented toward demonstrating supportive or contradictory grounds. In developing an agreeable conclusion, they performed supportive/*unsupportive response giving*, *assimilating response taking*, *declining response taking*, and *challenging response taking*. Since they did not carry out actual problems, they used backing and warrant most frequently to support their dialogic actions.

The type of **experiment proxy** refers to those OCI initiators who consistently attended to the open collective inquiry that they initiated but remained dependent on others' help in deriving working knowledge. Therefore, they carried out hypothetical solutions that others suggested and sincerely delivered outcomes of such efforts. However, their dialogic actions were limited in making own interpretations of such outcomes and directing own inquiry progress. Their interactions with other participants were quite unidirectional; dominant contributors told them what to do, and an OCI initiator reported what turned out. I identified three OCI initiators of this type from Forum A, one from

Forum B, and four from Forum C. This type of OCI initiators often built a close relation with a few participants and exchanged information requested. Thus, the number of OCI initiators' dialogic actions and that of other participants were almost equal. The quotation below exemplified such unidirectional interaction. A leading contributor requested an OCI initiator to do things to generate problem-specifying information in an explicit and *directive* manner. The OCI initiator followed the direction and derived the requested information.

> If you downloaded an .rpm file, then how did you install the driver? Sooner or later, the SW needs a PPD file associated with the printer queue.
> Please humor me and do one of two things:
> 1. Follow the steps I suggested
> 2. Post exactly the steps you used to install the print queue, specify the driver, and whether you did a test page. (L15-#4) — Action domain to frame a problem: directive: confused response giving
>
> [xyz@Wazirkutz ~]$ lpstat -t
> scheduler is running
> system default destination: Baig
> device for Baig: ccp:/var/ccpd/fifo0
> Baig accepting requests since Thu 13 Nov 2008 05:32:40 AM PKT
> printer Baig is idle. enabled since Thu 13 Nov 2008 05:32:40 AM PKT
> [xyz@Wazirkutz ~]$
>
> this is what it gives as a message... (L15-#5) — Action domain to frame a problem: expositive: constructive response giving

The distribution of dialogic actions in action domains and dimensions of dialogic actions confirmed such dependent attitude of this type of OCI initiators. Their dialogic actions were most frequent in the action domains to frame a problem and confirm workability. Since they did not have adequate understanding of their problematic situations, their problem description was mostly inadequate. Thus, others requested basic checkups to generate problem specifying information. Even when these OCI initiators received hypothetical solutions, mostly in a *directive* format, they simply reported outcomes

without providing what they found ineffective but meaning for a next try. Therefore, they performed *expositives* most frequently, which were needed in providing requested details and outcomes. In a similar vein, they performed *constructive response giving* and *declining response taking*. They used data frequently in delivering requested details that did not include these OCI initiators' reflection but was effective for others' interpretation.

The type of **solution taker** refers to those OCI initiators who behaved passively in collaborating with others to generate their knowledge desideratum. They were hesitant in carrying out hypothetical solutions suggested until they found such suggestions worthy to try. As such, they were evaluative and selective about others' suggestions, yet they were frugal in sharing what they had and in expending any effort to resolve their confusion. I recognized eight OCI initiators of this category from Forum A, one from Forum B, and six from Forum C. These OCI initiators were more focused on evaluating others' contributions and soliciting working solutions. Thus, dialogic actions for such purposes were predominant in dialogues hosted by them; OCI initiators more dialogic actions than others. For example, the quotations below exemplified how this type of OCI initiator acted in her inquiry. Although several participants approached to help this OCI initiator by requesting problem details and suggesting hypothetical solutions, the OCI initiators declined them saying that he already tried them or requested further explanation for his clarification. However, he never shared such ineffective outcomes for others to see what could cause his problematic situation.

> Ya, I have done the event linkage via the transaction SWETYPV... The 'release step event' is getting triggered twice and the changed event is not at all getting triggered. I have also attempted some changes in SWEC.
> But nothing works. (S2-#3)
> Please let me know about this. (S2-#4)

> Kindly reply to this soon..
> Thanks in advance for your help. (S2-#5)
> All the mentioned points by you have been checked already.... (S2-#9)
> How to check whether the change documents are getting created or not? If not, how to activate this? Kindly, give me assistance on this, as this is needed quickly.(S2-#10)

As such, their dialogic actions were most frequent in the action domains to negotiate solutions and to confirm workability. In these action domains, they assessed others' suggestions and reported ineffective outcome without adequate details. They demonstrated a pattern that is similar to principle investigators in the dimension of *action performed*. However, they performed less *constructive response giving* and *assimilating response taking* poorly. To the contrary, they performed *challenging response taking*, *declining response taking*, and *unsupportive response giving*. That is, they were attentive to their open collective inquiry in various action domains, but they were giving negative and uncooperative dialogic actions.

I identified five OCI initiators from Form A and three from Forum B to be bystander. This last type of OCI initiators proposed an issue but did not get involved in or left the open collective inquiry that they initiated after a few contributions. Thus, the number of OCI initiators' dialogic actions was much fewer than that of others. Unless someone who had a similar problem took the place of an OCI initiator, discussion threads that were initiated by these bystanders were likely to be ineffective. Since they did not perform many dialogic actions except in the action domain to initiate inquiry, no pattern in dialogic actions could be identified. However, flaming and distracted inquiry focus due to such flaming was commonly observed in such discussion threads owned initially by such OCI initiators.

Although qualitative accuracy should be compromised, the distribution of dialogic actions performed by other participants was largely in parallel with that of dialogic actions performed by OCI initiators. That is, how an OCI initiator performed is related with how others performed in response. For example, when OCI initiators behaved like principle investigator by attending open collective inquiry consistently and making positive and constructive contributions, they were more likely to receive similar patterns of dialogic actions from other participants. These OCI initiators had other participants' diverse dialogic actions consistently in all action domains. OCI initiators of coordinator had others' participation in all action domains except the action domain to frame a problem. Other participants performed dialogic actions that were related to discussion and validation frequently, such as supportive or *unsupportive response giving*, *assimilating response taking*, *declining response taking*, and *challenging response taking*. They also used backing, personal warrant, and general warrant heavily to ground their dialogic actions. OCI initiators of experiment proxy had others' participants in the action domain to frame a problem most frequently. Other participants performed *directives* predominantly telling OCI initiators what to do. Since OCI initiators could not describe problems adequately, other participants' dialogic actions were largely motivated for resolving confusion. OCI initiators of solution taker had the least number of other participants' dialogic actions. Since OCI initiators refrained from revealing adequate information, other participants performed *confused response giving* along with the minimal use of other types of dialogic action. Although OCI initiators of bystanders did not get involved in their open collective inquiry, the rest of such open collective inquiry

was doomed to be shaped by how other participants took their place of. If a third person took an OCI initiator's inquiry and handled it like principle investigator, the open collective inquiry dialogue could be effective. I observed three cases of such successful takeover.

Table 17. The Distribution of OCI Initiator's Role and Dialogue Closure

OCI Initiator's Role		Full closure				Partial closure				Non-closure				Degraded closure			
		Sum	A	B	C	Sum	A	B	C	Sum	A	B	C	Sum	A	B	C
Principle investigator	39	20	8	5	7	11	4	5	2	7	2	4	1	1	1	-	-
Coordinator	10	6	6	-	-	2	2	-	-	-	-	-	-	2	1	1	-
Experiment proxy	8	2	-	1	1	-	-	-	-	6	3	-	3	-	-	-	-
Solution taker	15	-	-	-	-	1	1	-	-	13	6	1	6	1	1	-	-
Bystander	8	1	-	1	-	2	2	-	-	4	2	2	-	1	1	-	-
sum	*80*	*29*	*14*	*7*	*8*	*16*	*9*	*5*	*2*	*30*	*13*	*7*	*10*	*5*	*4*	*1*	-

Given the patterns of dialogic actions depending on distinct types of OCI initiators, it was no wonder to observe a certain relationship between types of OCI initiator and that of dialogue closure. As presented in Table 18, active OCI initiators achieved more effective outcomes: 20 principle investigators reached a full closure, and 11 achieved working solutions with some satisfaction. Six coordinators derived agreeable conclusions through their opinionating inquiries, and two achieved some consensus on issues they inquired about. Although such active OCI initiators could fail in constructing working knowledge, the likelihood was much lower than passive and dependent OCI initiators, such as experiment proxy, solution taker, and bystander. Only six out of 31 OCI initiators in these categories attained working solutions, while rest of them could not demonstrate any success.

5.3. Types of Inquiry Context

I recognized that the fulfillment of essential dialogic actions in action domains was

related to distinct outcomes of open collective inquiry. How OCI initiators acted throughout their collective inquiries could shape distribution patterns of dialogic actions, which was in turn related with distinct open collective inquiry outcomes. In addition, I found that the three forums sampled for the present demonstrated a distinct distribution in the types of OCI initiators; Forum A demonstrated diverse types of OCI initiators: 15 principle investigators, nine coordinators, three experiment proxy, eight solution takers, and 5 bystanders; Forum B showed 14 principle investigators, three bystanders, and one of each other type of OCI initiator; and Forum C had 10 principle investigators, four experiment proxy, and six solution takers (See Table 16). Although the ratio of reaching effective closure was around 50% in all three forums, each forum demonstrated particular types of closure more or less. For example, four out of five degraded closures were observed in Forum A. A half of Forum C ended with non-closure (See Table 18). I thus realized that the here forums demonstrated distinct distribution of dialogic actions in each action domain (See Table 14). I reduced Table 14 covering only essential dialogic actions and presented average numbers of essential dialogic actions for the three forums in Table 19. I marked the average number of essential dialogic action in particular forums that was more than the average of all three forums.

Among the three forums, Forum A demonstrated the most numbers of dialogic actions almost in almost all categories of essential dialogic actions. Forum C performed the least number of dialogic actions in most categories. To recap, Forum A was a user forum of an open source community where participants have legitimate accesses to source code to question about the workability of knowledge source and to discuss further improvement.

Forum B was a user forum from a semi-open source community. Participants were encouraged to revise scripts and to update the repository, but their access to a source code was prohibited. Forum C was a user forum from proprietary software community where participants could inquire about how to use the software but were not allowed to access the software for modification. I identified three aspects of open collective inquiry dialogues that could distinguish these three forums in terms of their unique patterns of dialogic action: inquiry justification, validation of suggestions, and endeavor for improvement.

Table 18. The Distribution of Essential Dialogic Actions in Three Forums

	Action performed					**Content of action**				
	Classes	**Ave.**	**A**	**B**	**C**	**Classes**	**Ave.**	**A**	**B**	**C**
To initiate inquiry	expositives	2.6	**2.9**	**2.8**	1.9	constructive	3.8	3.8	**4.1**	3.4
	commisives	1.7	**1.8**	**1.8**	1.7	unsupportive	0.5	**0.6**	0.5	0.2
To maintain commitment	declaratives	0.6	**0.7**	**0.8**	0.5	supportive	3.1	**3.9**	**3.2**	1.3
	expositives	0.7	0.7	**1.2**	0.1	unsupportive	0.9	**1.1**	0.8	0.7
	commisives	2.5	**2.9**	**3.0**	1.4	challenging	1.0	1.0	**1.7**	0.2
To guide process	directives	2.4	**3.0**	2.4	1.5	assimilating	1.8	**2.5**	**1.9**	0.5
	commisives	2.6	**3.1**	**2.9**	1.3	challenging	2.7	2.7	**3.2**	2.1
	behavitives	16.9	**19.5**	11.5	**18.8**	conversational	16.9	**18.9**	11.0	**18.8**
To frame a problem	declaratives	3.0	**3.7**	2.8	1.7	constructive	6.3	**6.7**	**6.7**	5.3
	expositives	4.8	4.7	**5.6**	4.3	confused	4.4	**4.7**	3.1	**5.2**
	directives	4.2	**4.4**	3.0	**5.2**					
To negotiate solutions	declaratives	3.7	**5.3**	2.6	1.7	constructive	7.0	**8.9**	5.2	5.1
	expositives	6.9	**9.3**	5.3	3.9	supportive	2.1	**2.7**	**2.2**	0.9
	directives	7.7	**8.7**	6.8	6.5	assimilating	0.9	**1.2**	0.8	0.4
						unsupportive	2.5	**3.6**	2.2	0.9
						declining	2.3	**3.4**	1.4	1.2
						challenging	2.6	**3.1**	2.1	2.1
To confirm workability	declaratives	0.3	**0.4**	**0.5**	0.1	assimilating	1.4	1.4	**1.7**	0.9
	expositives	2.8	**3.2**	**3.0**	1.8	declining	1.2	1.2	**1.4**	0.9
	directives	0.7	**1.0**	0.7	0.3	challenging	0.9	**1.2**	0.8	0.3

First, dialogic actions for inquiry justification and inquiry dis-justification were most frequent in Forum A and Forum B, although the two forums demonstrated distinct characteristics. Participants in these two forums tended to maintain commitment not only

by conveying their goodwill and supports but also, more importantly, justifying the faithfulness of problems inquired about. In other words, participants were unlikely to expend their resources, such as time and expertise, when they did not believe problems inquired about to be worthy of their efforts and other members. In Forum A, participants disjustified inquiry for various reasons, such as incorrect assumption, general issues, irreparable condition, and insignificance (See Appendix A for detail). Others also counteracted against such inquiry dis-justification demonstrating evidence of problem occurrence and prior efforts. Forum B showed an intense tension between inquiry dis-justification and inquiry justification: the denial of problem existence and the recognition of problem occurrence. Participants denied problems inquired about largely because they could not reproduce the same problems and because they considered them due to wrong assumption. That is, such participants did not acknowledge that problematic situations could be caused by errors in scripts or even in the software. Thus, inquiry justification attempted to reassure the occurrence and the severity of the problems inquired.

For example, the quotations below exemplified such intense tension between inquiry dis-justification. The first two quotations denied the problem occurrence for wrong assumption and failed problem reproduction. Receiving such inquiry dis-justification, the OCI initiator became desperate and argued against them. However, he could not provide adequate evidence, and thus, the open collective inquiry did not attain a working solution. The fourth quotation exemplified inquiry justification that claimed the severity of a problem inquired about. Despite of several evidences indicating that the problem seemed to be caused by a more fundamental error in the software not in erroneous use of scripts,

the inquiry was poorly taken care of. To the contrary, Forum C rarely demonstrated such tension. Problems inquired about in this forum were mostly simple questions regarding how to use the program functionalities and did not intended to question about the program itself for improvement.

> No components in Flex 3 use TLF. They all use the Flash Player's TextField class (A10-#7) — Inquiry dis-justification: wrong assumption
>
> I am able to see the app on http://www.rafique-gilani.com/Dump/instacoll/tlfEmbeded Font/HindiTest. html as well as type text and get the source .. (A10-#15) — Inquiry dis-justification: failed problem reproduction
>
> No it is not working fine with other languages also. (A10-#28) — Inquiry justification: problem occurrence
>
> So please Adobe, please include your "users" (the developers) into your decisions and provide a fool-proof interface for using BASIC (!!!) XHTML data within Flash text components which ought to be used in combination with the TLF. (A12-#17) — Inquiry justification: problem severity

The distribution of dialogic actions in the action domain to maintain commitment supports such distinct characteristics of inquiry justification in these three forums. Participants in Forum B performed *declaratives* and *expositives* most frequently. They also performed the most number of *challenging response taking* that refused inquiry dis-justifying dialogic actions and reassured the severity of problems inquired about. Participants in Forum A performed an equal number of *declaratives* and *expositives*. They also performed similar numbers of *unsupportive response giving* and *challenging response taking*. It is interesting to notice that Forum A demonstrated the most *declaratives* in the action domain to frame a problem that consolidated problems inquired about initially. That is, in contrast to Forum B and Forum C that set up certain barriers in developing inquiry, Forum A was more open-minded toward any types of inquiry of various topics. Thus, Forum A not only justified the faithfulness of inquiry conceptually

but also, more importantly, could develop problems inquired about initially into common issues what were worthy of open collaboration through concrete consolidation of similar case descriptions.

Second, the validation of suggestions in the action domain to negotiate solutions was most noticeable in Forum A. Participants in the open source forum tended to accept others' suggestions reflexively by assessing the validity and trustworthiness of such suggestions rather than accepting/declining them passively. Not all contributions were unconditionally acknowledged and accepted. Participants declined, contradicted, or even denounced such contributions that did not have adequate plausibility and the validity. As such, participants who contributed their expertise needed to corroborate their statements to suggest hypothetical solutions and opinions using ground and reasons. They also competed with others' suggestions over better workability. That way, Forum A demonstrated a wide variety of dialogic actions in all dimensions, *action performed*, *content of action*, and *argumentative component*. This could provide better opportunities to derive working solutions and to extend an initial inquiry toward a next level. Forum A also performed *argumentative components*, such as data, personal warrant, and general warrant, predominantly compared with the other forums. Such validation of suggestions existed in Forum B and Forum C. Since these forums put constraints what could be inquired about and how such inquiry could be addressed, these two forums demonstrated relatively inactive in performing dialogic actions for such validation. Participants in these forums tended to provide explicit and *directive* solutions and helpful information and explanation to carry out such suggestions. Validations on such suggestions were most

likely to decline them, to support them, or to correct misinformation.

I present four quotations that exemplify such contrast below, although this does not mean that Forum A always performed rich dialogic actions. In the first quotation from Forum A, a participant suggested a *directive* solution, but he also provided his personal practice to support the *directive* solution to ensure the plausibility of the solution to the hearer. In contrast, the second quotation from Forum B simply provided explicit directions without any supportive ground. In a similar vein, the third quotation from Forum A exemplified a dialogic action that contradicted other's statement using adequate ground, whereas the fourth quotation from Forum C exemplifies a simple contradictory dialogic action.

> Let's try this: On my system, I have two printers: HP LaserJet 1022 and Epson stylus photo 900. I find basic configuration info in /etc/cups/printers.conf, and the .ppd files in /etc/cups/ppd. The .ppd files are named to match the names I gave the printers. I am not totally clear on the process, but I assume that these files are generated from generic information in /usr/share/cups. (There I find .ppd files with more generic names)
> So, try this: Install your printer and driver your way, and then look in /etc/cups/ppd and see if a .ppd file gets put there. (L15-#12) – Suggestion of hypothetical solution based on personal warrant
>
> Create a empty FLA .. type something in it .. change the font to Hindi and check the embed checkBox . Or import font in library. (A10-#38) – Suggestion of directive solution
>
> what is wrong with ext2? Based on <http://en.wikipedia.org/wiki/Ext2>, "ext2 is still the filesystem of choice for flash-based storage media (such as SD cards, SSDs, and USB flash drives) since its lack of a journal minimizes the number of writes. Flash devices have only a limited number of write cycles." It must be good for optical based media too. (L40-#10) – Contradiction for wrong assumption using backing and general warrant
>
> When you use the wapi FM I think you may not be able to pass complex container elements to the workflow container. (W16-#13) – Contradiction for wrong assumption

Third, the three forums demonstrated distinct extents of endeavor for improvement after deriving working solutions, although the numbers of fully closed open collective inquiry

dialogues were almost same in these three forms. Participants in effective collective inquiries — fully closed and partially closed dialogues — in Forum A and Forum B were likely motivated for improving problem-prone situations. They attempted to make sense of how derived working solution could solve problems inquired about, to make sure that such working solutions worked for others, and to post-produce derived solutions for others. They also continued to share limitations and unresolved issues.

> What we've done, likely, is established that acpi is the problem.
> Booting "noacpi" means that your fan will always run etc. Anything relying on power management will not work. For laptops, this can be pretty sucky but if you don't mind then that's as far as you need go.
>
> If you want power management, then you'll have to supply, and/or repair, the DSDT table which linux reports as missing. The acpi project often has working dsdt for download. But this is pretty much advanced-end work. It is just sad that some vendors provide the things needed for acpi to work in a non-standard place (i.e. so only windows will work).
>
> However - I often find that entering bios setup and disabling all the "advanced power" features does wonders. Often the advanced features in the bios are only needed to make up for deficiencies in windows. With your particular problem, there is often a power management option where you configure network devices. It may just be that bios put your nic to sleep when it was unused and the kernel could not turn it on. (L25-#19) – Post-production of derived solution
>
> FYI, I just created a blog (thanks for pointing out about Beta 1) on TextFlow, check it out at Flex 4: Threaded Text Using TextFlow <http://blog.allurefx.com/2009/07/flex-4-threaded-text-using-textflow.html>. (A19-#17) – Post-production of derived solution
>
> The issue was we need to pass releasecode separately using an functional module. (S3-#22) – Post-production of derived solution

The distribution of essential dialogic actions in Table 18 also supported such distinctions. Forum A and Forum B performed equivalent numbers of essential dialogic actions, such as *declaratives*, *expositives*, *directives*, *assimilating response taking*, *declining response taking*, and *challenging response taking*. However, the numbers of these dialogic actions were much lower in Forum C.

These distinct characteristics of the three forums indicated that the extent of access to knowledge source (e.g., software code) and openness to improvement is related with participants' dialogic actions. Forum A was the most open collective inquiry context and did not set any visible constraint in developing open collective inquiry. Participants cooperated to identify problematic issues, to negotiate solutions through discussion and argument over diverse suggestions and opinions, and to contribute derived working solutions for the sake of others. Forum B was constrained in raising problematic issues for open collective inquiry. Participants' inquiries regarding scripts were appreciated by software developers, but those regarding the software could not be promptly addressed; developers had a distinct revision cycle and plan for next revisions. Thus, any inquiry that infringed such barriers could generate intense tension between inquiry justification and dis-justification. Due to such barriers, dialogic actions for validations were not as active as Forum A. However, their endeavor for improvement was equivalent to that of Forum A. Forum C was the least active among the three forums in all aspects. This is probably because participants did not expect that such contribution of open collective inquiry progress and outcomes could be useful for the community.

Chapter 6. Discussions

In this chapter, I incorporate key findings of the previous chapters to propose a dialogic action model of open collective inquiry in online forums. This model explains that OCI initiators' active involvement and inquiry context influence participants' fulfillment in essential dialogic actions for open collective inquiry which in turn influences open collective inquiry outcomes. As such, I contend that OCI initiators' involvement becomes a more crucial antecedent of effective open collective inquiry in online forums than the abundance of knowledge resources available, i.e., knowledge contributors. Also, the inquiry context that encourages participants' unconstraint validation of shared knowledge and its improvement becomes a more important condition than an altruistic climate. I conclude this study by discussing its theoretical and practical implications.

6.1. Toward a Dialogic Action Model of Open Collective Inquiry in Online Forums

One of the benefits that online forums offer is that the heterogeneity of members' backgrounds and perspectives can be maximized by connecting people distributed in time and space without any pre-existing social structures. The online environment is an "information space" where people could share information and retrieve it (Lee et al. 2001). I consider online forum to be a particular form of such information space, in that participants of online forums get involved more actively in inquiry process to generate their desired knowledge rather than information search and retrieval. Participants who have similar experiences of problems conjoin to negotiate solutions by sharing their fragmented images of the problems and their disperse knowledge. This enables more

diverse problem analyses and solutions and richer discussion on various issues than one-on-one or one-on-many knowledge seeking and contribution structure. In a sense, what is shared in online forums is not readily applicable knowledge as "object" but an "inquiry process" that are open to distributed cognition. The environment of online forums provides records of such inquiry processes at various stages and allows literally unconstraint participations during an ongoing inquiry progress. In this context, how to organize such dispersed information to generate useful meaning through inquiry through rich representation becomes a crucial dynamics of open collective inquiry in the online forums. Therefore, I envision open collective inquiry in online forum as a participative sport in which multiple participants interact with others through dialogic actions to achieve particular inquiry objectives. Actor, context, and action are three instrumental factors that can influence open collective inquiry processes and outcomes (Figure 4).

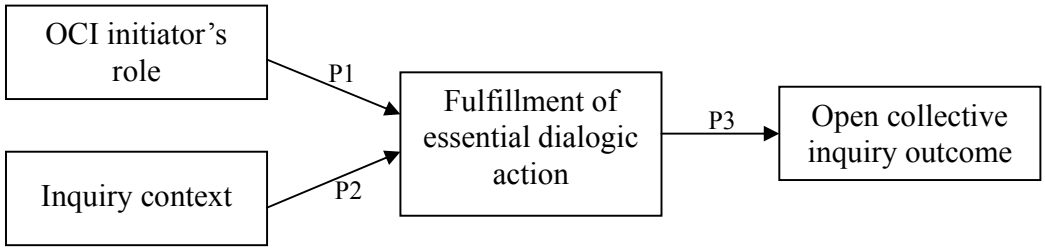


Figure 4. A Dialogic Action Model of Open Collective Inquiry

OCI Initiator's Role

Although the heterogeneous resources available in online forums should not be overrated, its critical tradeoff is unmanageable participation and resource allocation. Participants are not obliged to participate, or continue to participate, and to contribute what and to what extent. That is, how to call out dispersed knowledge resources and weave them to

generate working knowledge is of utmost significance. Due to the absence of an authorized organizer, participants emergently shape diverse roles while attending ongoing open collective inquiry (Faraj et al. 2011; Hutter et al. 2001). Among diverse emergent roles that participants shape I particularly highlight different roles that original posters who post an original posting in the online forum space. An original poster is the only entity that is predictably there to obtain desired knowledge. Thus, an original poster reasonably owns the discussion thread that she initiates; this is why I envision an original poster as open collective inquiry initiator (OCI initiator). To recall that learning is essentially a demand-side issue (Brown and Duguid 2002; Dewey 1938), open collective inquiry in online forum is essentially an issue of an original poster, and the success of open collective inquiry would be her involvement exercising her ownership to control unpredictable inflow of knowledge resource and converge it purposefully.

I found that OCI initiators exercised varying degree of involvement. Active OCI initiators, such as principle investigators and coordinators, participated consistently in all action domains as open collective inquiry progressed toward satisfying closures. They conveyed their appreciation to others' contributions with prompt and sincere undertaking of such contribution. They managed dispersed contributions effectively using converging points that summarized multiple prior replies in a single posting. Unhelpful and irrelevant contributions were declined for explicit reason and evidence because such contribution would distract their inquiry objectives and made other participants expend their resources on consumptive debate. These active OCI initiators took others' suggestions and opinions reflectively and undertook negotiated solutions through active experimentation. With

such diverse and extensive participation in every aspect of open collective inquiry, they themselves were a significant contributor who provided important information for problem solving and guide open collective inquiry flow and progress.

To the contrary, passive OCI initiators, such as experiment proxy, solution taker, and bystander, did not entertain their ownership relevantly. These passive OCI initiators were mostly dependent on others and expected others to provide working solutions. The experiment proxies earnestly followed key contributors with whom they established apprenticeship-like relations. These OCI followed their directions and responded their requests for additional information, but these experiment proxies were deprived of self-motivated inquiry actions and desire to get into the problem. Dialogic actions associated with significant extent of reflection, such as interpreting outcomes of experimentations, providing additional information voluntarily, and organizing dispersed helps, were scantily observed. The solution takers did not expend any effort to internalize others' suggestion nor participated in active negotiation for plausible suggestion. When they could not understand others' suggestions, they tended to request further explanation without any effort to help themselves. They mostly doubted or denied presumed workability of suggestions, as if other participants were competing for solution takers' satisfaction, which was obviously not the case in online forums.

Active OCI initiators and passive ones were distinct in performing dialogic actions requiring reflection and experimentation. According to Kolb' experiential learning theory (2005; 1984), learning occurs through the transformation of experience connecting

concrete experience, reflective observation, abstract conceptualization, and actual experimentation. Reflective observation and actual experimentation are two dialectically opposed counterparts in transforming experience into learning — perceiving and acting. That is, concrete experience needs be carefully reflected upon a learner's prior cognitive scheme and assimilated into her abstract conceptualization. The learner then actually experiments with the conceptualized experience and generates another concrete experience that becomes another source of experiential learning. Therefore, a learner's performance, an OCI initiator in this context, of reflection and experimentation is a critical factor that influences her achievement. Although this model is often considered as a theory of general learning and individual learning style (i.e., classroom learning (Felder and Silverman 1988)), the importance of reflection and experimentation is persistent in my findings in the collaborative, self-organizing learning environment. As shown in Table 17, how an OCI initiator performed for her open collective inquiry was closely related to what she could expect from other participants. The more active and reflective dialogic actions an OCI initiator performed, the more she could garner equivalent dialogic actions from others. This mutually constitutive interaction pattern influenced the extent of fulfillment of essential dialogic actions in open collective inquiry, which in turn influenced its outcomes. Active OCI initiators were more likely to achieve effective closures, compared with passive ones. Thus, I propose:

> **Proposition 1**: The extent to which an OCI initiator performs roles that entail the greater amount of reflection and experimentation, e.g., principle investigator and coordinator, is positively related with overall participants' fulfillment of essential dialogic actions.

Inquiry Context

I sampled three online forums purposively; an open source software user forum, a semi-open source software user forum, and a proprietary software user forum. The three forums differed in the extent to which each of the forums allowed participants' inquiry demand and outcomes to be integrated in its existing knowledge products, e.g., software code set. Online forums currently become a "must" in most online/offline communities, however, they were unique communication platforms of open source software development communities that have been widely recognized for their collaborative learning and knowledge management practice. Thus, online forums and their primitives, e.g., listserv, were considered as the imprint of online communities' learning practices and culture. Prior studies highlighted altruism and gift economy as a unique contextual condition of online forums that enabled free knowledge giveaway (Bergquist and Ljungberg 2001; Constant et al. 1996; Wasko and Faraj 2005). However, I was skeptic about how well such altruism and gift economy could be implemented in corporate organizational contexts adequately to generate similar collaborative learning practices. Furthermore, people increasingly use online forums and similar semantic web technology platforms to satisfy individuals' specific knowledge needs, and thus they tend to be motivated for specific problem solving by integrating dispersed knowledge. Such knowledge integration requires the modification of the initial knowledge and the recombination of the knowledge in new ways (Grant 1996a). In that sense, I presume that the reason online forums in open source communities are highly sustainable is because they make participants' open collective inquiry matter.

I compared dialogic action patterns of the three online forums and found an interesting point. Although the likelihood of attaining working solutions was similar in the three forums, these three forums demonstrated distinct patterns in fulfilling essential dialogic actions (Table 17). The open source user forum was the most active in performing dialogic actions of negotiating suggestions and validating its initial knowledge for improvement. Participants of this forum could establish problems of common interest without being constrained by any significant barrier. Of course, there were some participants who deprecated the trustworthiness of problems inquired about and the value of open collective inquiry. However, there was little tension in terms of what could be reasonably asked in this forum and how much improvement participants could expect. To the contrary, the proprietary software user forum was deprived of such discourses around inquiry justification and legitimate requests for improvement. Problems inquired about were mostly about how to use the software "as given," which did not need in-depth inquiry. As such, problems and solutions were exchanged largely like Q&A. Participants of the semi-open source software user forum were encouraged to inquire about scripts associated with the software and to update a script repository. However, they confronted with a barrier when they attempted to inquire about problems beyond the script level. Since the software had a firm revision cycle and pre-established revision plan, participants' inquiry to validate the workability of the software operated with the script repository and to endeavor for improvement were not properly incorporated.

That is, the semi-open source software user forum and the proprietary software user forum had explicit barriers between what could be inquired about and what should not;

they were supposed to adopt the software as it is and were not encourage to inquire about it. Therefore, inquiries about more fundamental problems associated with the software itself were barely justified and framed for further validation and improvement. On the contrary, open source user forum did not have such coercion in establishing legitimate problems. Although the open source software user forum did not outperform the other forums in terms of deriving working solutions, the forum was populated with critical discourses that questioned fundamental issues and negotiated future courses of open collective inquiries to improve its software performance.

This openness to validation and improvement becomes a crucial contextual condition in shaping online forums to be an ideal place for critical open collective inquiry dialogue. As Habermas (1990) urged, inquiry in public sphere could be encouraged when participants could express freely their doubt on established ideas and thoughts (p.89):

Every subject with the competence to speak and act is allowed to take part in a discourse.

A. Everyone is allowed to question any assertion whatever.

B. Everyone is allowed to introduce any assertion whatever into the discourse.

C. Everyone is allowed to express his attitudes, desires, and needs.

(3.3) No speaker may be prevented, by internal or external coercion, from exercising his rights as laid down in (3.1) and (3.2)

Without fulfilling this condition, online forums become an online version of helpdesk that only re-transmits “fixed” knowledge and lacks any capacity for generating knowledge. Argyris and Schön’s on organizational learning models (1982; 1978) lends insight to

further understand this condition of inquiry context. When organizational members only detect errors and correct them based on espoused theory taken for granted in a defensive manner, they are limited in achieving organizational innovation. Organizational innovation and learning occurs when organizational members are allowed to access data and information and to validate fundamental assumptions and governing values of their practices. Provided these theoretical insights, online forums' capacity for open collective inquiry undertaking critical scrutiny is valid only when their contexts allow unrestricted validation of their core knowledge source, e.g. software source code. This inquiry context lowers the barrier between *theory-in-action* and *espoused theory*, and provides better opportunities to transform individuals' dispersed experience and theories-in-action into organizational knowledge. Thus, I propose:

> Proposition 2: The extent to which a host of open collective inquiry is open to critical discourse of validation and improvement is positively related with overall participants' fulfillment of essential dialogic actions.

Fulfillment of Essential Dialogic Actions

Collective action, such as collaborative learning and collective problem solving, is embodied in organizational processes through which participants organize their "moves" to respond to emergent knowledge desideratum in situ (Pentland 1992; Pentland and Rueter 1994). The importance of such process become greater in online forums settings where participants are mostly strangers to one another and lack structured patterns of behaviors. The exchange of problems and thoughts was the key activity of open collective inquiry. Participants shared their experiences of breakdown, constructed a

shared image of problem, analyzed and synthesized prior knowledge to generate hypotheses, tested them against problematic situations of breakdown, and constructed new working knowledge. I identified essential dialogic actions in each action domain of open collective inquiry (Table 10) and analyzed the relationship between fulfillment of such essential dialogic actions and open collective inquiry outcomes (Table 14). The more participants performed essential dialogic actions, the more likely they achieved working solutions. These dialogic actions were performed based on reflection, experimentation, and validation.

For example, I found three categories of *action performed* in this regard: *expositives*, *directives*, and *declaratives*. *Expositives* demonstrating facts and evidence was the most fundamental dialogic actions in most action domains except in the action domain to guide inquiry flow. Such facts and opinions became ground of developing open collective inquiry. For example, the extent to which an OCI initiator provided an initial problem statement varies from a simple generic complaint to well-elaborated description, and so do reflective observations. It is the exchange of such fragments through which inquirers patch fragmented images of the breakdowns and generate a shared image of the problematic situation. Participants including an OCI initiator thus kept updating their dispersed experiences of problematic situations and findings until they framed a problem adequately. This required continuing reflective observation on the problematic situations to generate more facts and evidences. Likewise, participants also needed to exposit corroborative ground and backing of hypothetical solutions while they negotiated for better plausibility. *Directives* that told others future courses of action were performed to

resolve infelicitous situations of self or of others. To resolve infelicitous situation of self, participants preformed *directives* requesting additional information and explanation. For example, a participant requested problem-specifying details to resolve her uncertain conception of problem description. To resolve others' infelicitous condition, participants told them to do something. When a participant suggested a hypothetical solution to an OCI initiator, she expected the OCI initiator to follow her suggestion to resolve problematic situations inquired about. Theses *directives* required other participants to conduct actual experimentation of suggested hypothetical solutions and to share any reflection on their outcomes. Participants performed *declaratives* to validate the effectiveness and the trustworthiness of others' prior dialogic actions. They performed *declaratives* to confirm the existence of a problem inquired about. In that way, they consolidated the establishment of the problem initially inquired about. In the action domain to construct solution, participants assessed hypothetical solutions and opinions based on various criteria, such as truth, relevance, and affordability. They also performed *declaratives* when asserting the effectiveness of such solutions after actual experimentation.

Likewise, *content of action* provided by such essential dialogic actions entailed significant extents of reflection, experimentation, and validation. These dialogic actions were essential in open collective inquiry because inquirers' cognizance and available existential materials is most likely incomplete and possibly wrong (Dewey 1938; Kolb 1984; Newell and Simon 1972). Thus, dialogue that embodies open collective inquiry continuously reflects, experiments, and validates such limitations. Through such dialogic

actions, participants overcome their limits of bounded rationality and expand the boundaries of their local knowledge. Thus, I propose:

> Proposition 3: The extent to which OCI participants fulfill essential dialogic actions required for each action domain is positively associated with the likelihood of obtaining satisfying working solution.

Open Collective Inquiry Outcomes

Emphasizing participants' collective effort to negotiate and validate solutions, I adopted the pragmatic view of knowledge; knowledge is not absolute or transcendental but, rather, situated and relational. Dewey (1938) states that knowing is to de-structure "doubt" and produce "belief". Doubt is the recognition of an uncertain, confused, or undetermined state of mind where we fail to respond properly to the breakdown in the environment with prior beliefs and do not know how to act. Doubt is not an isolated psychological phenomenon but an existential one that is always connected to a whole set of contextual events. Doubt comes from the disorder of its niche that one cannot figure out how to control and direct environing conditions. Belief, to the contrary, is a settled state where knowledge warrants reliably ongoing, self-correcting processes of inquiry in every conceivable situation. Dewey calls the state of belief *warranted assertibility* with which one is ready to act in a given way. Thus, knowledge has a functional value that depends on the particular locality of the context such as problem-solving power, and its trustworthiness is determined by the extent to which the knowledge offers successful consequences consistently in as many contexts as possible. Knowledge is only a state of "warranted assertibility" that is subject to being modified and replaced through ongoing

falsification efforts. Knowledge is not merely a closure of inquiry but also an instrument for further inquiry to cope with problems in the ongoing world.

Inquirers generate an indeterminate subject-matter that is waiting to be made specific and concrete. The indeterminate subject is tentative, *ad hoc* hypothesis with which inquirers attempt to address specific attributes of problematic situation and revise readily to get better a better working knowledge *(*Buchanan 1992). The process is similar to how a designer explores a design situation, identifies design problems, and develops an artifact solving the situation. Designers intuitively or deliberately position and reposition quasi-subject matter against indeterminate situation and iteratively revise the quasi-subject matter. Through the iterative efforts of positioning and repositioning the problem and the issue at hand, inquirers develop working hypotheses, or abstract conceptualization. The problem is embedded in our daily routines, and the reliability of the working hypothesis is based on its pragmatic value such as usefulness and relevancy to the specific problematic situation. It is actual experimentation in the problematic situation that carves out any element of indeterminacy in the working hypothesis and endows the validity of warranted assertibility to it. Throughout the exchange of experience at different levels of learning, inquirers with different inquiry styles contribute their specialized experiences to shape open collective inquiry.

Learning in this context does not mean simply understanding of the true nature of things or memorizing objectified knowledge. Rather, it is a participative sport by which a learning agent transforms and constructs knowledge for particular problematic situation.

Dewey (1938) denotes learning "coming to know," which underscores self-motivated, knowledge-guided activity of an individual who deliberately seeks what he needs in order to do what he wants to do. Dewey states "Inquiry is the controlled or directed transformation of an indeterminate situation into one that is as determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole" (pp. 104-105, 1938). Knowledge and action, or *theory and application*, are not independent domains; action is always planned, designed and exercised by knowledge. The activity of inquiry entails continued reflexiveness and enactment by which an agent navigates his or her environment purposefully, conceives the world, and engages in attempts to cause changes within the environment (Weick 1979; Weick 1993).

Provided, I conceptualized the four types of open collective inquiry closure as a way to distinguish the level of participants' satisfaction in terms of working knowledge and adequate sense making of it. That is, what brought most participants into a felicitous condition where they resolved doubt and established belief in the derived knowledge was considered as working knowledge. Participants needed to exercise iterative self-reflection and reconstruction to attain knowledge desideratum relevant to the unique locality of our problem.

6.2. Research Implications

6.2.1. Theoretical Implications

This dissertation study provides an action-oriented theoretical framework of investigating open collective inquiry in online forums. Online forums become increasingly recognized for their affordances for integrating dispersed knowledge to generate unique situated knowledge, rather than simply aggregating it. Indeed, there exists a growing body of literatures that investigate and implement the affordances in the form of "open innovation". Although such research emphasizes collaborative interactions that are central to knowledge integration, firms' open innovation initiatives tend to be shaped like competition hampering opportunities for integration (Boudreau et al. 2011; Chesbrough et al. 2006; Dahlander et al. 2008; Fredberg et al. 2008; West and Gallagher 2006). To reduce the negative effect, researchers urge the need of proper intervention to manage participants' interactions, such as incentives and intervening roles (Boudreau et al. 2011; Fleming and Waguespack 2007; Hutter et al. 2001). However, how participants should act is largely unexplored. Despite the abundant body of literature on collaborative learning in online forums, it is deprived of theoretical frameworks that explain how collaborative learning generates effective outcomes, *descriptive implications,* and what participants should do to improve it, *prescriptive implications*. There are several established organizational learning theories that those studies adapt to online forums' collaborative learning, such as Kolb's experiential learning (2005; 1984; 2001), Argyris and Schön's on organizational learning models (1982; 1978), and communities of practice model (Brown and Duguid 1991). These theories consistently explain that organizational members achieve learning through exchanging and transforming individuals' knowledge. However, how to achieve such transformative knowledge creation has been taken for granted.

Perhaps, that is because members are cognizant about their alleged roles in organizational contexts. However, online forums as a socio technical platform inherit the great extent of uncertainty in positioning such roles and performing relevant actions. The present study demonstrates essential dialogic actions of open collective inquiry and how these dialogic actions achieve various aspects of knowledge transformation during open collective inquiry. Future study can use the dynamic process of open collective inquiry to derive descriptive understandings of collective action in various contexts such as collaborative problem solving, knowledge generation, and open innovation. The dialogic action model of open collective inquiry could provide prescriptive insights.

This study demonstrated the importance of communication activities to sustain online forums in a qualitative manner. That way, I elucidated how communication activities, dialogic actions in this study, embody processes of collective problem solving and knowledge generation. Although online forums depend solely on dense dialogue, communication activities have been plainly studied through quantitative measurements, such as thread count, message volume, and the number of participants. However, such quantitative measurements are limited in addressing the centrality of communication activities in online community's sustainability and learning capacity (Butler 2001; Ridings and Wasko 2010). The six types of action domain and the three dimensions of dialogic actions provide an adequate variety of combinations that could characterize qualitative aspects of communication activities in the context of open collective inquiry. Future study can further improve the present study's methodology. I chose discussion threads primarily based on the number of replies, presuming that more participants

contribute more replies depending on their involvement to open collective inquiry. Here, I was self-contradictory to some extent. Future study can benefit from a more purposive sampling method that also should not deteriorate generablizability. For example, future researchers are encouraged to sample discussion threads dealing with similar topics, which allow them to more focus on distinct impacts of dialogic actions on open collective inquiry processes and outcomes. The current sampling method could not exclude potential biases due to topic importance. In addition, researchers who intend to adopt the quantitative dialogic action model of open collective inquiry (Figure 4) are encouraged to use word counts instead of line count. That would allow a more sensitive variance extraction.

I proposed a dialogic action analysis adapted to the purpose of studying open collective inquiry processes in this ICT-enabled communication genre. The dialogic action analysis preserves fundamental premises of the established three methods ─ discourse analysis, conversational analysis, and argumentative analysis ─ but overcomes their limitations in the unique context of open collective inquiry in online forums. Qualitative methods such as field study, ethonomethodology, or case study, are widely utilized to understand collaborative learning, but these methods usually provide explanations at the macro-level. The dialogic action analysis, to the contrary, enables a large-scale qualitative analysis on the micro dynamics of social inquiry. However, the current coding scheme comprised of four dimensions each of which also has five to nine categories is too complicated to be effectively procured. Thus, I suggested the revised coding scheme (Appendix D) and an alternative ways to improve intercoder reliability. Future study can reproduce it for their

research. The current coding is limited in analyzing a large-scale data and needs human intervention. Future study is needed to solve this issue and develop *efficient* dialogic action analysis method.

This study two-level research design provides an alternative way to investigate processes of open collective inquiry. Van de Van (2007) proposes two ways of theorizing a process. One is a sequential development — event A follows event B, and the other is relations between concepts to generate change — concept A relates to concept B. By analyzing distribution patterns of dialogic action taking place in various action domains of open collective inquiry, the dialogic action analysis offers a spatial approach. Each action domain constitutes an essential component of the open collective inquiry process and is closely intertwined with other action domains. Participants interact with others within and across action domains to fulfill purposes of each action domain and to balance the fulfillment with those of other action domains; for example, the problem specification in the action domain to frame a problem needs be balanced with the suggestion of hypothetical solutions in the action domain to negotiate solutions to generate a working solution. The dimensions introduced in the dialogic action method form a ground to bridge qualitative findings with quantitative suggestions, although the two approaches are viewed to offer different, somewhat contradictory, explanations, i.e., (Trauth and Jessup 2000). Classes of each dimension pertain interpretive meaning extracted from various dialogic actions, and they can be itemized to generate construct measurements.

6.2.2. Practical Implications

The dynamics of open collective inquiry consisting of the six action domains (Figure 2)

provide implications for designing online forum space for better open collective inquiry. Boland et al. (1994) propose that online forum space should be designed to support group dialogue among distributed individuals. Ackerman (2000) points out that there is significant social-technical gap in current CSCW design because of inadequate considerations of flexible, nuanced, and contextualized human activity. Majchrzak et al. (2005) recognized that adequate delivery of rich contextual information became a key challenge in this context. However, online forum space is commonly designed to present open collective inquiry development using a sequential elongation of discussion threads. Even many platforms for open innovation and collective idea generation that emphasize knowledge integration use such design principles. In this kind of sequential representation, dispersed contextual information and participants' reflection are likely to be segmented and lost. The spatial representation of open collective inquiry processes clusters dispersed information onto particular types of action domains based similar themes and to connect one another through relevant moves. Such spatial clustering allows participants to manage diverse contextual information more effectively. This becomes a critical design requirement that can shape online forums and expert systems beyond preliminary expert system that can handle wh-problems on *declarative* knowledge (Brézillon 1999; Gruber 1993; Newell and Simon 1972).

The dialogic action model of open collective inquiry provides insight for design methodology. Design problems are often wicked, ill-defined, and unforeseeable outside user context, and the domain of design and that of use is divided (Buchanan 1992; Rittel and Webber 1973). Thus, it is very important to identify ill-defined problems, to

intercalate the two domains of design and use, and to evaluate the relationship of problems and design artifacts for pragmatic values. This necessitates thorough understanding of how design knowledge is captured, written-down, communicates, and tested at the intersection of knowledge of the properties of physical objects (Gregor and Jones 2007). In s similar vein, Conklin and Yakemovic (1989; 1991) claimed that an artifact-oriented approach in software development was most likely to lose important insights raised during prior design processes, how and why, and that such loss became a challenge in maintaining and updating design artifact. The dialogic action model of open collective inquiry presented in this study envisions that reflection, experimentation, and validation are essential qualities of critical open collective inquiry. It demonstrated how participants could perform such qualities through dialogue. In this way, this dialogic action approach becomes an effective means to reduce indeterminacy in practical lives and endows determinacy to design artifacts with pragmatic value and offers a potential methodology for system design.

Appendix A. A List of Codes from Open Coding

	categories	codes		Total	Forum	Forum	Forum
Action domain to initiate inquiry	commitment	1.	appreciation a priori	28	20	4	4
		2.	commit to take suggestion	6	6	0	0
		3.	expectation for working solution	2	2	0	0
		4.	inquiry justification - controversy/doubt	2	2	0	0
		5.	inquiry justification - prior efforts/invalid search	36	19	14	3
		6.	inquiry justification - problem	15	9	4	2
		7.	inquiry objectives/desideratum	54	20	18	16
		8.	self-introduction - delimited expertise/experience	5	5	0	0
		9.	solicit help/attention - general	30	11	9	10
		10.	summary/restatement of specific topic	13	11	1	1
		11.	title - explicit question (specific need)	10	5	4	1
		12.	title - opinionating	7	6	1	0
		13.	title - problem location	5	4	0	1
		14.	title - problem symptom	27	16	6	5
		15.	title - problem topic	29	9	9	11
	demonstration	16.	problem description - general background/possible	6	2	4	0
		17.	problem description - initial problem diagnosis	8	7	1	0
		18.	problem description - problem severity/pervasive	5	4	1	0
		19.	problem description - specific context	67	39	12	16
		20.	problem symptom - observation	46	20	14	12
		21.	problem symptom - raw data	24	13	11	0
				425	***230***	***113***	***82***
Action domain to maintain commitment	commitment	22.	check whether suggestion is considered	1	0	0	1
		23.	convey interest/goodwill	52	30	9	13
		24.	empathy	13	12	1	0
		25.	engage in continued problem solving effort	66	40	23	3
		26.	expect constructive inquiry/contribution	13	7	6	0
		27.	promise sincere undertaking	46	34	7	5
				191	***123***	***46***	***22***
	encourage	28.	discouraged/frustrated	16	11	5	0
		29.	encourage - difficulty for adequate problem solving	14	11	3	0
		30.	encourage (partial/complete) progress	23	15	3	5
			compliment	8	6	1	1
		31.	merit of proposed inquiry	31	25	6	0
		32.	value of information	21	10	7	4
				113	***78***	***25***	***10***
	inquiry norm	33.	advice for constructive inquiry	16	12	2	2
		34.	concede to criticism	2	2	0	0
		35.	inadequate prior efforts	6	4	0	2
		36.	irrelevant response-contributing manner	6	2	0	4
		37.	problematic manner (poor participation/self	15	13	0	2
				45	***33***	***2***	***10***
	inquiry justification	38.	prior effort	11	9	1	1
		39.	inquiry justification - problem	17	10	6	1
		40.	inquiry justification -problem severity/significance	25	7	18	0
				53	***26***	***25***	***2***
	inquiry dis-	41.	avoidable	4	3	1	0
		42.	general/natural	11	6	1	4

Action domain to guide inquiry flow	justification	43.	incorrect assumption/wrong choice	17	8	7	2
		44.	insignificance	5	4	1	0
		45.	irreparable/no solution	7	6	0	1
		46.	unproblematic situation	10	0	8	2
				54	***27***	***18***	***9***
	appreciation	47.	designated/specific appreciation	170	87	51	32
		48.	general appreciation	96	56	18	22
				266	***143***	***69***	***54***
	greeting	49.	greeting	296	75	42	179
	de-flaming	50.	apology/preemptive excuse	51	30	14	7
		51.	apology/preemptive excuse	9	8	0	1
		52.	diverse better opinions	15	10	5	0
		53.	de-flaming - humor/joke/personal mode	26	23	2	1
		54.	delimited knowledge/possible misinformation	62	45	11	6
		55.	metaphor	7	3	3	1
				170	***119***	***35***	***16***
	flaming	56.	depreciation	9	9	0	0
		57.	false statement	12	12	0	0
		58.	inadequate/invalid trustworthy	21	17	4	0
		59.	insistence	5	5	0	0
		60.	sarcasm	7	7	0	0
				54	***50***	***4***	***0***
	inquiry flow	61.	alternate - alternative inquiry focus	32	12	12	8
		62.	alternate - avoid assertion	4	4	0	0
		63.	close - attain adequate result	15	9	6	0
		64.	close - suggest to start new thread	9	7	1	1
		65.	close -no need further discussion with new topic	5	2	3	0
		66.	coordinate - exclude irrelevant contributions	14	11	2	1
		67.	coordinate - forbid further contribution	7	7	0	0
		68.	coordinate - introduce/add another issue	33	24	7	2
		69.	coordinate - narrow down options/ desired response	20	14	3	3
		70.	coordinate - prioritize desired inquiry	4	3	1	0
		71.	coordinate - repeat inquiry purpose/objective	46	22	13	11
		72.	coordinate - set next inquiry step/objective	16	12	3	1
		73.	parallel - check other's inquiry status/response	14	9	3	2
		74.	parallel - report individual inquiry update and	87	57	23	7
		75.	promise solution improvement	1	0	0	1
		76.	recess due to continued ineffective inquiry outcome	9	9	0	0
		77.	recess due to information overload	2	2	0	0
		78.	request help - specific needs/desired response	84	37	31	16
		79.	resume - problem reoccurrence	5	5	0	0
		80.	resume - remind pending/problem persistence	18	11	2	5
		81.	solicit help - general	56	23	15	18
		82.	solicit help - wait for response	14	10	2	2
		83.	solicit complete solution (no commitment)	2	1	1	0
		84.	upcoming solution	2	2	0	0
				499	***293***	***128***	***78***
	turn-taking	85.	moderator intervention	3	3	0	0
		86.	private correspondence	5	5	0	0
		87.	designate response by name	250	95	46	109
			partial quote to denounce	39	39	0	0
		88.	partial quote for partial concession and counter	8	8	0	0

		89. partial quote to ask confirm	4	4	0	0
		90. partial quote to contradict	58	48	4	6
		91. partial quote to correct	14	14	0	0
		92. partial quote to designate response	179	134	19	26
		93. partial quote to refer to	5	5	0	0
		94. partial quote to request specific information	10	10	0	0
		95. partial quote to support other statement	16	16	0	0
		96. self-partial quote	5	5	0	0
		97. whole quote to contradict	9	9	0	0
		98. whole quote to correct	4	4	0	0
		99. whole quote to denounce	7	7	0	0
		100. whole quote to designate response	87	84	3	0
		101. whole quote to support	2	2	0	0
			705	***492***	***72***	***141***
Action domain to frame a problem	thread title	102. inquiry outcome	2	2	0	0
		103. manage inquiry process	6	6	0	0
		104. problem alignment	6	6	0	0
		105. problem reoccurrence	2	2	0	0
		106. summary/emphasis	4	4	0	0
			20	***20***	***0***	***0***
	problem specification	107. add problem detail/further explanation	152	82	47	23
		108. confirm inquiry intent/detail	5	1	0	4
		109. output detail	8	4	4	0
		110. provide requested output detail	30	10	6	14
		111. provide requested problem detail	110	59	14	37
		112. request basic checkup	68	28	12	28
		113. request explanation	2	1	0	1
		114. request problem clarifying detail	52	30	9	13
		115. request problem specifying detail	125	76	27	22
		116. symptom - describe observation	8	4	4	0
		117. symptom - raw data	17	8	9	0
			577	***303***	***132***	***142***
	problem consolidation	118. confirm problem occurrence	29	15	13	1
		119. diagnose problem	9	7	2	0
		120. solicit solution	19	12	3	4
		121. specificity	7	5	2	0
		122. suggest experience-based solution	13	11	2	0
			77	***50***	***22***	***5***
	problem diagnostic	123. assertion/error point	37	13	15	9
		124. conjecture	72	44	15	13
		125. delimit potential cause	21	16	3	2
		126. interpret experiment/experience	20	16	4	0
		127. little clue	15	13	2	0
			165	***102***	***39***	***24***

Action domain to negotiate solutions	response giving	128. help - address/confirm other's	66	46	16	4
		129. help - describe problem	47	30	1	16
		130. help - direct link for additional detail	42	31	7	4
		131. help - follow-up other/own statement	26	12	6	8
		132. help - preemptive/additional information	116	87	12	17
		133. hesitate - poor response/irrelevant response	5	4	1	0
		134. hesitate - vague/tricky objective	9	6	3	0
		135. non-assertion/potential inaccuracy	45	21	20	4
		136. provide - alternative solution	100	55	28	17
		137. provide - answer/details on request	85	38	24	23
		138. provide - assertion	16	10	0	6
		139. provide - competing solution	48	33	6	9
		140. provide - direct link as response	32	24	8	0
		141. provide - explicit *directive* solution	42	19	12	11
		142. provide - solution b/conjecture	53	32	7	14
		143. provide - solution b/personal practice	47	41	4	2
		144. provide - solution only	32	16	7	9
		145. provide - suggestion b/general practice	44	32	8	4
		146. support own- direct link/verify source	36	30	2	4
		147. support own - expected outcome	29	21	5	3
		148. support own - personal expertise(trustworthy)	3	3	0	0
		149. support own personal practice	68	64	3	1
		150. response giving - support own general practice	31	23	0	8
			1022	***678***	***180***	***164***
	response taking	151. accept/agree	9	9	0	0
		152. confusion/inadequate understanding	18	14	2	2
		153. convey inability to follow suggestion/request	14	7	1	6
		154. decline - limited affordability/availability	13	8	3	2
		155. decline - no-novelty/irrelevancy/non-preference	50	28	11	11
		156. decline -ineffectiveness	3	3	0	0
		157. decline -problem solved	2	2	0	0
		158. defer acceptance until confirming	36	17	9	10
		159. recognize hidden merit	1	1	0	0
		160. request - confirmation on own understanding	26	11	7	8
		161. request - confirmation on other's	16	5	7	4
		162. request detail/explanation	117	52	39	26
		163. synthesize multiple opinions/suggestion	20	19	0	1
			325	***176***	***79***	***70***
	response validation	164. contradict - false statement	52	47	2	3
		165. contradict - general practice	26	21	5	0
		166. contradict - inadequate trustworthy	12	11	1	0
		167. contradict - partial concession to counterargument	15	9	5	1
		168. contradict - wrong assumption/counter example	71	53	10	8
		169. correct - irrelevant conjecture/counter example	30	23	5	2
		170. correction - other's misunderstanding/error	57	35	12	10
		171. correction - own mis-/poor understanding	18	8	7	3
		172. denounce - incorrect presumption	12	12	0	0
		173. denounce - insignificance	5	5	0	0
		174. denounce - poor understanding and rejection of	12	10	2	0
		175. denounce - self-contradicting argument	3	3	0	0
		176. denounce - irrelevance and ineffectiveness	18	17	1	0
		177. support other - agree/ extend	38	35	2	1

		178. support other - agree/confirm	65	40	18	7
		179. tradeoff	15	15	0	0
			449	***344***	***70***	***35***
Action domain to confirm workability	workability	180. explanation on failure/error	27	13	8	6
		181. report outcome - adequate success	44	19	14	11
		182. report outcome - ineffective	93	54	21	18
		183. report outcome - partial success	23	14	3	6
		184. report outcome detail- evidence (raw data, capture)	17	17	0	0
		185. request output detail	33	26	6	1
			237	***143***	***52***	***42***
		186. attempt to extend workability/sensemaking	21	12	5	4
		187. confirm workability of suggested solution	14	9	4	1
		188. limited workability and poor sensemaking	33	19	10	4
		189. report error/limitation	12	10	2	0
		190. problem pending in other context	10	6	4	0
		191. reproduce derived solution	12	8	4	0
		192. summary and explain	14	9	3	2
		193. potential irrelevancy/limitation	9	8	1	0
			125	***81***	***33***	***11***
			5868	3586	1186	1096

Appendix B. Axial Coding Worksheet and an Example of Axial Coding

	performative verbs														
	declaratives			*expositives*			*directives*			*commissive*			*behavitives*		
ad	pr		ar.	pr		ar.	pr		ar.	pr		ar.	pr		ar.
initiate inquiry				p-symptom (observation)						(T) explicit q-	x		general appreciation	x	
				p-symptom (raw)	x					(T) opinionating			specific appreciation		
				specific p-context	x					(T) p-location			greeting		
				general p-context						(T) p-symptom			delimited expertise		
				p-severity						(T) p-topic			humor		
				p-diagnosis						inquiry objective	x				
				p-summary						sincere undertaking					
				controversy						expectation for w-solution					
				prior effort	x	8				help/attention	x				
				p-occurrence											
Build and maintain commitment	avoidable p-			prior effort			problematic attitude			interest/ goodwill			value of contribution		
	general p-			p-existence			inadequate prior effort			embrace criticism			merit of inquiry		
	wrong assumption			p-severity /urgency			Irrelevant/in-effective resp			sincere undertaking	10		difficulty in inquiry	20	
	irreparable condition						how to inquire constructively			continued involvement			achievement/ progress		
	insignificance	20								solution soliciting			empathy		
										expectation for w-solution			frustration/ discourage		
Manage dialogue flow													false S		
													inadequate trustworthy		
													depreciative remark		
													insistence		
													sarcasm		
													delimited expertise	14/18	
													metaphor		
													humor		
													moderator intervention		
													name calling	11/14/21/23	
													pt-quote-own	17	
													pt-quote-other	7/10/19/20	
													wl-quote-other	14/21	
													diversity		
													apology	4	
													greet	8	
													general-apprc.	10/11	
													specific-apprc.		
Manage inquiry flow	info- overload						alternative direction			general help/response			diversity better solution		
	continued futility						start a new thread			specific help/response	11				
	Irrelevant contribution						suggestion as possibility			p-reoccurrence					
	unwanted contribution						desired response	21	D	pending inquiry					

							narrowed down options			other's inquiry progress					
							repeated objective			own inquiry plan/progress					
							irrelevant contribution			give up					
							direct next step								
							another/new issue								
							p-solved								
Build image of problem	error occurrence			requested details			specifying details	20	Q						
	solution seeking			additional details	5 10		clarifying details	6 18							
	proposing experi-ential solution			requested output details	5 11 16 17	D B/D B/D D	basic checkup	3	B						
	p-diagnosis			simple answer											
	particular problem						better p-description								
Build consensus on solution	outright-taking-in			direct link to more detail			assertive solution			other-statement			hesitant to contribute	2	
	credit hidden value			explanation for uncertainty	4 12 22 24	Q B	direct link			other-S w/extension			potential ineffectiveness		
	synthesis of multiple sugg			preemptive/ additional info	3 8 20 24		solution b/ personal prc	18	PW	own-S direct link					
	non-novelty/ inaffordability			follow-up own	15	PW	solution b/ conjecture	2 7 13	D D	own-S general prac					
	deferred taking-in	14		follow-up other			solution b/ general prc			own-S personal prac	15				
	mis-/poor-information			pt-concession to contradict			solution only	6		own-S personal expert					
	incorrect presumption			false statement			explicit/directive solution	8	B	own-S expected outcome	18 22	D B			
	insignificant contribution			unusual prac			competing solution	20 24		expectation for solving					
	poor understanding			insincere/ little trustworthy			alternative solution	22	B	confusion/ poor understanding					
	self-contradiction			wrong assumption			explanation on suggestion	14 23		inability to follow suggestion					
	irrelevance/ ineffectiveness			own-misinfo/ understanding	6		confirmation on own understand								
	assertive diagnosis	7	W	other-misinfo/ understanding	19		confirmation on other stat								
	conjectural diagnosis	2 9 12	Q	Irrelevant conjecture											
	experimental interpretation			tradeoff											
	potential p-cause														
	intermittent consensus														
	little clue														
Validate workability	workability of solution			ineffective result			outcome details	6							
				partial success											
				adequate success			explanation on outcome	5 16							
				limited workability											
				sensemaking of w-solution											
				extended workability											
				error in solution											
				reproduction of w-solution											

Appendix C. Hierarchical Coding Guide

Coding Instruction

Script of a discussion is pre-segmented into paragraphs for your coding. Please read each segment of text and code it for four dimensions: action domain (A.D.), action performed (A.P.), content of action (C.A.), and argumentative component (A.C.). Therefore, **you will code one text segment four times in four different ways.** Please refer to following categories of each dimension and mark down a relevant code for each segment.

**This coding scheme preserves original wording.*

First, please refer to the classes of action domain below and mark a code number in the first column.

Action Domain (A.D.) – the first column (Purpose of segment)			
code	categories	Descriptions	Examples
1	To initiate inquiry	Statements that initiate dialogue	original posting
2	To build and maintain commitment	Statements that evaluate value and truth of problems raised in an original posting	to justify/dis-justify problems, to demonstrate/retreat commitment or support, to criticize inquiry attitude and norms
3	To manage dialogue and inquiry flow	Statements that organize dialogue flow or inquiry process but do not relate explicitly to problem specification or knowledge construction	flaming/de-flaming, humor, greeting, appreciation, quoting, demand for contribution, tempo control, coordination
4	To specify problem	Statements that construct better understandings of problems	to request/provide problem details, to report problems
5	To construct solution	Statements that construct solutions	to suggest potential solutions, to support/contradict such suggestions, to diagnose problem causes
6	To validate workability	Statement that confirm/disconfirm workability of suggested solutions or to extend them	to report outcomes of testing solutions, to provide summary/explanation of solutions

Second, please refer to the classes of action performed below and mark a code number in the second column.

Action Performed (A.P) – the second column (What a speaker want to do to a hearer)			
code	Definition	Examples	Quotes
1	To evaluate the truth or trustworthiness of other statements	inquiry dis-justification, problem diagnosis and consolidation, validation of solutions and opinions	*I don't think that problem is caused by dirty contacts. My old picture card is clean and my old card reader reads my new card without problems. I think it's a kind of undeterministic bug in my old card. I will try to create a few mytoutfileimages to see the results.*
2	To exhibit facts, opinions, and explanations	Problem justification, description, and specification, correction, explanation	*For other workflows I have never found such issue, I mean after doing it as General task and after assigning the agent in the expression it used to go as a workitem of that particular agent but here it is going as workitem of initiator as well, which is logically not correct.*
3	To get the hearer to do something or to request the hearer's action	Request of detail and explanation, and fulfillment, observation of norm	*You didn't give us any clue what background jobs you're even going to run.*
4	To commit the speaker or the hearer to do some future course of action	Commitment, future direction, support for other statement	*Let me try again. Going back to the first image you provided, to get:*
5	To give or take dialogic reaction or attitude to other statements	Flaming/de-flaming, quotation, designation, greeting, appreciation, excuse	*I have provided information that is more relevant to the issue than posting silly throughput readings that might be skewed, but nobody took the offer.*

Third, please refer to the classes of content of action below and mark a code number in the third column.

Content of Action (C.A.) – the third column (types of content delivered by action)				
	Felicitous condition			
	Response giving		*Response taking*	
	Less – relationship with prior statements – more		*less – internalization – more*	
	1. Constructive response giving	*2. Supportive response giving*	*3. Compliant response taking*	4. Assimilative response taking
Examples	Title Problem diagnosis Inquiry objective Description of problem context Preemptive/additional information Description of problem symptom Requested output details Suggestion of solutions Explanation for uncertainty	Confirmation on prior statement Follow-up prior statement Empathy Interest/ goodwill/ involvement Merit of inquiry Value/credit of contribution	Diversity Embracing criticism Sincere undertaking	Workability/reproduction of solution Inquiry direction/ plan/ focus Experimental interpretation Consensus Summary/synthesis Partial concession/tradeoff Confirmation on workability
	Infelicitous condition			
	Response giving		*Response taking*	
	less – relationship with prior statements – more		*less – internalization – more*	
	5. Unsupportive response giving	*6. Confused response giving*	*7. Declining response taking*	*8. Challenging response taking*
Examples	Inquiry dis-justification Hesitance of helping/ contribution Problematic attitude Contradiction Insistence Poor understanding Ineffectiveness Failed sensemaking Irrelevance	Request for basic checkup/details/output Request for explanation Controversy Frustration/ discourage Inquiry norms Confusion/ poor understanding	Ineffectiveness/irrelevance Abandonment Information overload Non-novelty/ inaffordability Wrong assumption	Alternative solution Another/emergent issue Deferred acceptance Expectation for solving Inability/ limited affordability Error/ limited workability Pending inquiry progress/ Solution seeking Desired help/ repeated objective Problem justification
	9. Non-felicitous condition			
Examples	Appreciation Greeting Name calling	Moderator intervention Quotation of prior statement Delimited expertise/excuse		

Fourth, please refer to the classes of argumentative component below and mark a code number in the fourth column.

Argumentative component (A.C.) – the fourth column (components to support statement)			
code	categories	Descriptions	Examples
1	Data	Facts that are not interpreted	picture (snapshot), number, code set
2	Backing	Indications that lead to sources of warrants	hyperlinks to resource, references
3	Personal warrant	Statements that use personal practice to support the reliability of a claim	It is so because that is what I do effectively
4	General warrant	Statements that use general practice to support the reliability of a claim	It is so because that is what others believe so.
5	Qualifier	Words or phrases that express a degree of force	probably, impossible, certainly, presumably

Appendix D. Revised Hierarchical Coding Guide

Coding Instruction

This coding intends to identify various types of dialogic action occurring in discussion threads in online forums at four different dimensions. A discussion thread consists of one original posting and multiple replies to it. When participants of a discussion thread are voluntarily engaged in verbal (textual) interaction to generate working solutions for a problem inquired about in an original posting, we consider it as collective inquiry dialogue; participants exchange information and thoughts about problems and potential working solutions. As such, the dialogues presented for your coding were sampled from online software user forums.

Text of this discussion thread is pre-segmented and provided as coding units (sentences, paragraphs, or phrases). You are asked to assess each of them according to four criteria. First, you are asked to examine a purpose of each segment of text, *what it intends to do*, using six categories provided. The second and the third coding ask you to examine *how a segment of text performs the purpose* identified in the first coding. In the second coding, you are asked to examine what type of action each segment of text performs to achieve a purpose identified in the first coding. Five categories are provided for this coding. In the third coding, you are asked to identify what type of content each segment of text provides as a meaning part of an action identified in the second coding. Nine categories are provided for this coding. If you feel uncomfortable with these nine categories to opt for, you are allowed to go for an alternative coding method that I described. Finally, you are asked to examine what type of a supportive part a segment of text uses. Since not all segments of text include such supportive parts, segments of text that were identified as including any of them were marked to reduce the complexity of coding. However, you are allowed to identify additional incidences of supportive parts. Five categories are provided for this coding. Descriptions of each category and its examples are provided in detail below.

Coding 1: Action Domain (A.D.)

The first column next to segments of text is where you are asked to input a relevant code of a purpose that a segment of text intends to achieve. This first dimension is called action domain. Six action domains are identified based on their distinct purposes of collective inquiry that are indicated in segments of text. Although a collective inquiry proceeds from an opening toward an ending, segments of text might not follow the direction linearly. They tend to move back and forth among the six action domains. Thus, read and think a purpose of each segment of text independently as well as conjunctively of other segments and of an overall flow. Please mark a corresponding code number to each segment of text.

Coding 1 - Action Domain		
code	**categories**	**Descriptions**
1	**Action domain to initiate inquiry**	Statements of an original posting that initiate a discussion thread
2	**Action domain to maintain commitment**	Statements that intend to convey or refuse support and commitment (i.e., to advise inquiry norm and attitude; to justify/dis-justify problems; to criticize inquiry attitude and norms)
3	**Action domain to guide inquiry flow**	Statements that intend to organize dialogue flow or inquiry process or convey conversational behaviors (i.e., flaming/de-flaming, humor, greeting, appreciation, quoting, demand for contribution, tempo control, coordination)
4	**Action domain to frame a problem**	Statements that intend to frame a problem (i.e., to request/provide problem details, to report problems, to diagnose problem causes)
5	**Action domain to negotiate solution**	Statements that intend to exchange solutions and opinions about the solutions (i.e., to suggest potential solutions, to support/contradict such suggestions)
6	**Action domain to confirm workability**	Statement that intend to confirm/disconfirm workability of suggested solutions or extend them (i.e., to report outcomes of testing suggested solutions, to provide summary/explanation of solutions)

Coding 2: Action Performed (A.P.)

The second column next to segments of text is where you are asked to input a relevant code for a type of action that an utterer performs for collective inquiry. This coding needs to be considered in conjunction with the first coding of action domain. For example, if you coded a segment of text for action domain to frame a problem previously, you need to investigate how an utterer performed the problem framing, e.g., is this person requesting details, is he providing things, is he diagnosing problem causes, and so on. Thus, action performed is often associated with types of verb or verb phrases. Five types of action performed are provided for your coding. Please refer to the classes of action performed below and mark a code number in the second column.

Coding 2 - Action Performed		
code	**Categories**	**Definition**
1	**Declaratives**	Segments of text that evaluate the truth or trustworthiness of other statements (e.g., inquiry dis-justification, problem diagnosis and consolidation, validation of solutions and opinions)
2	**Expositives**	Segments of text that provide supportive or unsupportive information to prior segments of text in performing a particular purpose that you identified in the Coding 1 (i.e., describing something, providing objective facts and ground, explaining something, etc.)
3	**Directives**	Segments of text that attempt to get the hearer to do something or to request something in performing a particular purpose that you identified in the Coding 1 (i.e., proposing solutions or opinions, indicating desired help and contribution, requesting additional information, etc.)
4	**Commisives**	Segments of text that convey psychological support, to commit to future courses of action, or to build inquiry norms in performing a particular purpose (i.e., indicating goodwill and interest, updating progress and future direction, conveying support for prior segments of text, etc.)
5	**Behavitives**	Segments of text that express conversational behaviors or that demonstrate unhelpful/harmful attitude or mitigate negative effects of such remarks in performing a particular purpose that you identified in Coding 1 (i.e., greeting, name calling, quotation, appreciation, flaming/de-flaming, excuse, etc.)

Coding 3: Content of Action (C.A.)

The third column next to segments of text is where you are asked to input a relevant code for a type of content. Such a content of action is accompanied with a particular performative that you identified in Coding 2 to achieve a purpose identified in Coding 1. Thus, this third coding is in conjunction with the Coding 1 and Coding 2. Content of action is often associated with clause. If a segment of text consists of multiple sentences with multiple clauses, please identify the most outstanding and overarching meaning. When a segment of text does not have a clause, please identify underlying meaning of what the segment of text intends to talk about. For example, if you coded a segment of text for action domain to frame a problem previously and if you identified its action performed as demonstratives, you need to examine a type of content that the demonstrative intends to provide, i.e., is it a content of constructive giving, supportive giving, confused taking, and so on. You are asked to code each segment of text considering two conditions under which content of the segment is given. The two conditions are felicity and reflection whose description is given below. Combining these two conditions, I provided five categories below:

> **Felicity:** Whether an utterer is satisfied with, agreed with, or fully understandable with what were said in other person's prior segments of text.
> **Reflection:** Whether an utterer explicitly considers contents of other person's prior segments of text or depends upon them in deriving her content of dialogic action (responding to prior contents by itself does not constitute reflection, and reflection must include part(s) of prior content and indicate how such part(s) are understood (internalized).

	Reflection	**Non-reflection**
Felicity	**1. Felicitous reflective content:** content is given when an utterer fully understands and agrees with prior statement and derives content explicitly using content of prior statement	**2. Felicitous unreflective content :** content is given when an utterer fully understands and agrees with prior statement BUT does not make her content using content of prior statement (i.e., initial suggestion)
Infelicity	**3. Infelicitous reflective content:** content is given when an utterer negatively or poorly understands and disagrees with prior statement BUT derives content explicitly using content of prior statement (i.e., contradiction)	**4. Infelicitous unreflective content:** content is given when an utterer negatively or poorly understands and disagrees with prior statement and does not make her content using content of prior statement (i.e., dis-justification)
Non-felicity	**5:** a statement does not include inquiry-related content (i.e., conversational element such as greeting, appreciation, and quotation)	

Coding 4: Argumentative Component (A.C.) (Optional)

The fourth column next to segments of text is where you are asked to input a relevant code for a type of argumentative component. Argumentative components are particular part(s) of a segment of text that are used for supporting its purpose (identified in Coding 1), action performed (identified in Coding 2), or content of action (identified in Coding 3). The argumentative components are viewed to be supplementary, so not all segments of text have any of them. You are asked to assess what types of argumentative component are used in those segments. Five types of argumentative components are provided for your coding. Please refer to the classes below and mark a code number in the fourth column.

code	categories	Descriptions	Examples
1	Data	Facts that are not interpreted	picture (snapshot), number, code set
2	Backing	Indications that lead to sources of warrants	hyperlinks to resource, references
3	Personal warrant	Statements that use personal practice to support the reliability of a claim	It is so because that is what I do effectively
4	General warrant	Statements that use general practice to support the reliability of a claim	It is so because that is what others believe so.
5	Qualifier	Words or phrases that express a degree of force	probably, impossible, certainly, presumably

Appendix E. Four Illustrative Cases

Thread 1: Full Closure

Page: 1/27

0001 06-06-08, 06:07 AM
0002 #1 — #1
0003 OP
0004 Member
0005
0006 Registered: May 2008
0007 Posts: 320
0008 Thanked: 22
0009
0010 **Does Linux can damage the picture card?** — OP - title - explicit question (specific need)~
0011
0012 *** If you have the problem with reading your picture card, you'll find in that thread a lot of useful hints. *** — post - reproduction - reproduce derived solutic
0013
0014 *** Bingo! 81% of photos recovered completely; 9% are fit to some corrections in GIMP; 10% useless ***
0015
0016
0017 I have a big problem. — OP - problem description - problem severity/pe
0018 Last night I took a lot of pictures using my Fujifilm FinePix F30 camera with Olympus xD Picture Card (H 512 MB) -- among them a dozen or so of really great pictures. At home I tried to mount my picture card using hama USB 2.0 Card Reader and my newly installed Slackware 12.1 but I couldn't do it. I'm not familiar with 2.6 series kernels and all those magic devices, so I switched back to Slackware 11.0 with 2.4 series kernel and tried to mount that card as I did it in the past but without success. Then I put it back to the camera and it said: ``CARD NOT INITIALIZED''. Finally I switched to Windows XP. It suggested me to format my picture card. I don't want to format it. I'd like to recover my pictures. — OP - problem symptom - observation~
0019
0020 My picture card was good before I removed it from my camera and something wrong happened when I attached it to my machine and tried to mount it in my new system. Now it's useless. — OP - inquiry justification - problem occurrence/
0021
0022 The xD picture card in hama's card reader should be seen in the system as /dev/sdd1 device. When I plugged in to my machine the card reader with the picture card for the first time /var/log/messages registered:
0023
0024 kernel: usb 4-4: new high speed USB device using ehci_hcd and address 3 — OP - problem symptom - raw data~
0025 kernel: usb 4-4: configuration #1 chosen from 1 choice
0026 kernel: scsi1 : SCSI emulation for USB Mass Storage devices
0027 kernel: scsi 1:0:0:0: Direct-Access Hama Card Reader CF 1.9C PQ: 0 ANSI: 0 CCS
0028 kernel: sd 1:0:0:0: [sda] Attached SCSI removable disk
0029 kernel: sd 1:0:0:0: Attached scsi generic sg0 type 0
0030 kernel: scsi 1:0:0:1: Direct-Access Hama Card Reader MS 1.9C PQ: 0 ANSI: 0 CCS
0031 kernel: sd 1:0:0:1: [sdb] Attached SCSI removable disk
0032 kernel: sd 1:0:0:1: Attached scsi generic sg1 type 0
0033 kernel: scsi 1:0:0:2: Direct-Access Hama CardReaderMMC/SD 1.9C PQ: 0 ANSI: 0 CCS
0034 kernel: sd 1:0:0:2: [sdc] Attached SCSI removable disk
0035 kernel: sd 1:0:0:2: Attached scsi generic sg2 type 0
0036 kernel: scsi 1:0:0:3: Direct-Access Hama Card Reader SM 1.9C PQ: 0 ANSI: 0 CCS
0037 kernel: sd 1:0:0:3: [sdd] Attached SCSI removable disk
0038 kernel: sd 1:0:0:3: Attached scsi generic sg3 type 0
0039 kernel: sd 1:0:0:3: [sdd] 1024000 512-byte hardware sectors (524 MB)

kernel: sd 1:0:0:3: [sdd] Write Protect is off
kernel: sd 1:0:0:3: [sdd] 1024000 512-byte hardware sectors (524 MB)
kernel: sd 1:0:0:3: [sdd] Write Protect is off
kernel: sdd: unknown partition table

At the same moment /var/log/syslog registered:

kernel: sd 1:0:0:3: [sdd] Assuming drive cache: write through
kernel: sd 1:0:0:3: [sdd] Assuming drive cache: write through

When I tried the command mount -t vfat /dev/sdd1 /mnt/tmp it complained:

mount: special device /dev/sdd1 does not exist

The command fdisk -l /dev/sdd displayed some information about my picture card but complained about invalid partition table:

Disk /dev/sdd: 524 MB, 524288000 bytes
17 heads, 59 sectors/track, 1020 cylinders
Units = cylinders of 1003 * 512 = 513536 bytes
Disk identifier: 0xffffffff

Disk /dev/sdd doesn't contain a valid partition table

The command fdisk /dev/sdd displayed less valuable information:

Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel with disk identifier 0xecb40075.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): q

OP - inquiry justification - prior efforts/invalid s

I have two questions:

1. Does Linux can damage the picture card?

2. How can I recover my pictures, and if I can't, is there any service capable to do it?

OP - summary/restatement of specific topic~

At the moment the second question is much more important for me than the first.

inquiry flow - coordinate - prioritize desired inc

Help me, please.

OP - solicit help/attention - general~

Have a nice day...

Last edited by OP: 06-07-08 at 06:39 PM.. Reason: resume

06-06-08, 06:59 AM
#2
P1____
Moderator

#2

Registered: Aug 2001
Location: Fargo, ND
Distribution: SuSE AMD64
Posts: 12,382
Thanked: 175

Do you have an identical card? Maybe you could copy the first 256 bytes from a good card to the bad one and see if the file system itself is damaged.

response giving - help - describe problem~

To things to google for to recover files from a fat32 filesystem are testdisk and photorec. <http://www.cgsecurity.org/wiki/TestDisk>

response giving - help - direct link for additiona

06-06-08, 07:02 AM
#3

#3

P2
Senior Member

Registered: Jun 2004
Location: Osaka, Japan
Distribution: Debian Sid/kde3.5
Posts: 2,233
Thanked: 79

Yanking the card out without using a safe unmounting procedure can corrupt the filesystem.
Linux often uses an asynchronous writing system, which means that the data actually sits in a buffer for a while before physically being written to disk, so you have to make sure the data is synced before removing it. Calling the umount command in cli will automatically run sync before finishing the unmount, and there's also a 'sync' command you can use to do it manually. In gui there's likewise always some kind of 'unmount' or 'safely remove' option.

problem diagnostic - conjecture~

You can try to run dosfsck on the drive and see if you can get it to repair the filesystem. Failing that there are some recovery tools that can find lost files, such as such as testdisk/photorec.

response giving - provide - solution b/conjectu

BTW, when it comes to data recovery it's usually a good idea to use dd or ddrescue to create an disk image to work on instead of working directly on the drive itself.

response giving - help - preemptive/additional

For better responses please read HOW TO ASK A QUESTION <http://www.linuxquestions.org/linux/answers/LinuxQuestions_org/How_To_Ask_a_Question>.
And when you get an answer:
a) Post a follow-up comment letting people know it worked.
b) Thank those who've helped you (click the thumb icon).
c) Mark the thread as "solved" (located in the "thread tools).

For printer and scanner drivers:
FSG OpenPrinting TurboPrint <http://www.turboprint.info/> Sane <http://www.sane-project.org/sane-mfgs.html> VueScan <http://www.hamrick.com/vsm.html> Avasys <http://avasys.jp/hp/menu000000500/hpg000000442.htm>

06-06-08, 07:05 AM
#4

#4

P3

Member

Registered: Apr 2005
Location: UK
Distribution: Slackware 12.2
Posts: 240
Thanked: 5

Well, I very much doubt that Linux did anything to your card unless you typed some incredibly silly commands. — response validation - contradict - wrong assum

I reckon that you may have better luck with: — response giving - provide - solution b/conjectu

mount -t vfat /dev/sdd /mnt/tmp

because it looks like (as in many cameras), the card does not have a real partition table or the card reader "ignores" the partition table, and everything is just stored straight onto the card itself.

If not, an idea would be to do: — response giving - provide - alternative solution

dd if=/dev/sdd of=/image-of-my-card

and analyse the image file that you get from that. This will prevent any further damage occuring to your card by things that you try, because you'll have "backed up" an image of it.

You can then make multiple copies of that file and do things like:

fdisk /image-of-my-card

and let it try to "fix" any problems it sees because it will be operating on the image file.

My guess would be that either the resulting file would be mountable if you don't try to look for a particular partition, contain all-zeros or you actually have a card reader not capable of reading the card properly (which can happen with cheap readers, SD cards of > 2Gb and/or SDHC cards in an SD card reader etc.). — response giving - support own - expected outc

Try a friends card reader and NEVER let anything format it, if you are determined to recover the information. You may well be able to recover a lot of things from the card's image file itself if you have a working hardware combination. — response giving - help - describe problem~

I also tend to find that my camera gives this message when it's batteries are dead, no matter what SD card I put in. It's also possible that the camera died while writing to the card which may have corrupted it. — response giving - support own - personal pract

---

06-06-08, 07:07 AM
#5
P4 — #5
Member

Registered: Apr 2005
Location: UK
Distribution: Slackware 12.2

Posts: 240
Thanked: 5

Quote: Originally Posted by P3.
Yanking the card out without using a safe unmounting procedure can corrupt the filesystem.

turn-taking - partial qoute to denounce

This only really counts if data was written to the card while he had it in Linux. The commands he ran shouldn't ever write to the card.

response validation - denounce - irrelevance a

06-06-08, 07:13 AM
#6
P2.
Senior Member

Registered: Jun 2004
Location: Osaka, Japan
Distribution: Debian Sid/kde3.5
Posts: 2,233
Thanked: 79

#6

His express question was "Can Linux damage a card", so I mentioned a way in which data can indeed get corrupted. You're right though in that it doesn't necessarily apply to this situation.

response validation - correction - own mis-/po

For better responses please read HOW TO ASK A QUESTION <http://www.linuxquestions.org/linux/answers/LinuxQuestions_org/How_To_Ask_a_Question>.
And when you get an answer:
a) Post a follow-up comment letting people know it worked.
b) Thank those who've helped you (click the thumb icon).
c) Mark the thread as "solved" (located in the "thread tools).

For printer and scanner drivers:
FSG OpenPrinting <http://www.freestandards.org/en/OpenPrinting> TurboPrint <http://www.turboprint.info/> Sane <http://www.sane-project.org/sane-mfgs.html> VueScan <http://www.hamrick.com/vsm.html> Avasys <http://avasys.jp/hp/menu000000500/hpg000000442.htm>

06-06-08, 07:16 AM
#7
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#7

To P1:

turn-taking - designate response by name

I haven't identical picture card. I will buy it if I'll haven't recovered data from the present one using any other methods.

commitment - promise to conduct/consider su

Thank you for the valuable link.
I will consider the use of TestDisk carefully.

appreciation - designated/specific~

0235
0236 **To P2:** — turn-taking - designate response by name
0237
0238 I don't removed that card without unmounting it -- in fact I couldn't even mount it because of the corruption of the file partition table. — response validation - correct - inrelevant conjec
0239
0240 I tried the method you suggest: — workability - report outcome - ineffective~
0241
0242 # dd if=/dev/sdd of=xd-dd.img
0243 dd: reading `/dev/sdd': Input/output error
0244 63968+0 records in
0245 63968+0 records out
0246 32751616 bytes (33 MB) copied, 105.335 s, 311 kB/s
0247
0248 The command dd cannot read entire /dev/sdd.
0249 I will consider the use of dosfsck on the drive. — commitment - promise to conduct/consider su
0250
0251 Thank you for the help. — appreciation - designated/specific~
0252
0253 **To P2. (cont.):** — turn-taking - designate response by name
0254
0255 I tried dd_rescue /dev/sdd xd-ddr.img command. It recovered slightly more bytes than dd (32768000), then stopped for a while, and then displayed thousands of errors and short summary at the end: — workability - report outcome - ineffective~
0256
0257 dd_rescue: (info): ipos: 511999.5k, opos: 511999.5k, xferd: 511999.5k
0258 * errs: 959999, errxfer: 479999.5k, succxfer: 32000.0k
0259 +curr.rate: 5376kB/s, avg.rate: 1100kB/s, avg.load: 12.3%
0260 dd_rescue: (warning): /dev/sdd (511999.5k): Input/output error!
0261
0262 dd_rescue: (info): ipos: 512000.0k, opos: 512000.0k, xferd: 512000.0k
0263 * errs: 960000, errxfer: 480000.0k, succxfer: 32000.0k
0264 +curr.rate: 12195kB/s, avg.rate: 1100kB/s, avg.load: 12.3%
0265 dd_rescue: (info): /dev/sdd (512000.0k): EOF
0266 Summary for /dev/sdd -> xd-ddr.img:
0267 dd_rescue: (info): ipos: 512000.0k, opos: 512000.0k, xferd: 512000.0k
0268 errs: 960000, errxfer: 480000.0k, succxfer: 32000.0k
0269 +curr.rate: 5435kB/s, avg.rate: 1100kB/s, avg.load: 12.3%
0270
0271 It looks very bad...
0272
0273 Now I try to figure out how to use dosfsck with one of that files. — commitment - promise to conduct/consider su
0274
0275 **To P3:** — turn-taking - designate response by name
0276
0277 I tried to mount /dev/sdd just after /dev/sdd1: — workability - report outcome - ineffective~
0278
0279 # mount -t vfat /dev/sdd /mnt/tmp
0280 mount: wrong fs type, bad option, bad superblock on /dev/sdd,
0281 missing codepage or helper program, or other error
0282 In some cases useful info is found in syslog - try
0283 dmesg | tail or so
0284
0285 That command has no sense in my system.
0286
0287 My xD picture card is recognized by Slackware 11.0 as /dev/sdd1 and should be recognized as /dev/sdd1 by Slackware 12.1. I have also other camera -- it uses CompactFash. Both Slackwares -- 11.0 and 12.1 -- recognize it as /dev/sda1. — problem specification - add detail/further expla

I tried dd as well as ddrescue, as I wrote above. The results are very poor. — workability - report outcome - ineffective~

I tried fdisk trick you suggest:

```
# fdisk xd-dd.img
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel with disk identifier 0x0f623715.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

You must set cylinders.
You can do this from the extra functions menu.
Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 25: Inappropriate ioctl for device.
The kernel still uses the old table.
The new table will be used at the next reboot.
Syncing disks.
```

The output of dd and the output of fdisk differ:

```
# cmp xd-dd.img xd-dd.img.new
xd-dd.img xd-dd.img.new differ: byte 1, line 1
```

Now I wonder what can I do with that new file.

To all the guys: — turn-taking - designate response by name

I've just displayed both recovered files (from dd and from ddrescue) with Midnight Commander Viewer's Hex mode. Both those files contain merely FF's -- from the beginning to the end. — problem specification - add detail/further expla

Files ,,repaired" with fdisk have 00's between sector 00000000 and 000001F0, and FF's to the end.

It looks very bad.

Last edited by OP; 06-06-08 at 05:54 PM.. Reason: update

06-06-08, 07:28 AM — #8

#8

P1____

Moderator

Registered: Aug 2001
Location: Fargo, ND
Distribution: SuSE AMD64
Posts: 12,382
Thanked: 175

The photorec utility is the one I think I would start with to recover the — response giving - provide - solution only~

pictures. It will recover other filetypes, but it was written particularly for this purpose:
<http://www.cgsecurity.org/wiki/PhotoRec>

It won't write to the device. It recovers files to your home directory.

06-06-08, 07:50 AM
#9 — #9
P5
Moderator

Registered: Nov 2005
Location: Pasadena, CA
Distribution: Mepis
Posts: 12,065
Thanked: 177

I have used photorec on several CF cards--nice tool. — response validation - support other - agree/ ex

For OP; — turn-taking - designate response by name
It's better not to post so much stuff when describing a problem---people can get lost. — inquiry norm - advice for constructive inquiry~

Also, flash memory does go bad. If I did not read anything else here, the part about dd not reading the whole card is suspicious. dd does not care about filesystems or anything else--it just reads raw data. — inquiry disjustification - general/natural~

---

* Getting started with Linux <http://--->
* Booting and GRUB <http://---> *

"It's always something." --Emily Litella (Gilda Radner, 1946 - 1989)

06-06-08, 10:26 AM
#10 — #10
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

As I said above I tried both dd and ddrescue. Both don't read the drive to the end. Both report Input/output errors. Both recovered files contain only FF's -- from the beginning to the end. — workability - report outcome - ineffective~

***

I tried PhotoRec for the three times in three modes:

1. Paranoid : Yes (Brute force disabled)
2. Paranoid : Yes (Brute force enabled)
3. Paranoid: No

For the three times it leaved recup_dir empty.

***

I tried my camera on the internal memory. It works.

0397 ***
0398
0399 Now I'm pretty sure my picture card is not logically but physically damaged. I will find some data recovery company to send my picture card to it. — problem diagnostic - conjecture~
0400
0401 ***
0402
0403 Thank you all guys for your help. It was very instructive for me. It's a pity that all those hints failed. — appreciation - general~
0404
0405 ***
0406
0407 Thank you P5 for your advice. I will try to trim down my eloquence in the future. I'm so garrulous, because I try to depict the problem entirely, and in the result I become boring. I'm sorry. — inquiry norm - concede to criticism~
0408
0409 *Last edited by OP; 06-06-08 at 01:56 PM.. Reason: simplify*
0410
0411
0412 06-06-08, 12:09 PM
0413 #11 — #11
0414 P5
0415 Moderator
0416
0417 Registered: Nov 2005
0418 Location: Pasadena, CA
0419 Distribution: Mepis
0420 Posts: 12,065
0421 Thanked: 177
0422
0423 Quote: — turn-taking - partial qoute to denounce
0424 *I'm little tired after sleepless night -- of course my picture card is damaged -- my camera doesn't read it. Software methods are exhausted -- now I need to find hardware service.*
0425
0426 I don't understand. If you cannot re-format the card (in your computer or in the camera) just discard it. There's nothing to repair. — inquiry disjustification - irreparable/no solution
0427
0428 Before doing anything else, get another card and try it in the camera and the computer. — response giving - help - preemptive/additional
0429 _____
0430 * Getting started with Linux <http://--->
* Booting and GRUB <http://---> *
0431
0432 "It's always something." --Emily Litella (Gilda Radner, 1946 - 1989)
0433
0434
0435 06-06-08, 01:14 PM
0436 #12 — #12
0437 OP
0438 Member
0439
0440 Registered: May 2008
0441 Posts: 320
0442 Thanked: 22
0443 **Original Poster**
0444
0445 As I know storage devices can be logical damaged (they require non-invasive procedures of repairing) and physical damaged (they require invasive procedures of repairing). There are companies — inquiry flow - parallel - report individual inqu

specialized in data recovering, for example: <http://www.ontrackdatarecovery.com/>. Invasive recovery procedures are about twice times as expensive as non-invasive ones. Non-invasive ones are about ten times as expensive as 512 MB xD picture card.

After all my tests I'm practically sure that my picture card is not software but hardware damaged. I intend to send it to some company similar to the one mentioned above.

problem diagnostic - interpret experiment/ex

I don't know if I can or cannot reformat my picture card. I didn't try it. I don't want to format it. I want to recover my pictures.

response taking - decline - no-novelty/irrelevar

Last edited by OP; 06-06-08 at 01:27 PM..

06-06-08, 06:31 PM
#13
P5
Moderator

#13

Registered: Nov 2005
Location: Pasadena, CA
Distribution: Mepis
Posts: 12,065
Thanked: 177

If you can't recover the pictures with tools already discussed, then by all means try a recovery service.

inquiry disjustification - irreparable/no solution
inquiry flow - alternate - alternative inquiry focu

I don't know what "hardware repair" you have in mind for a solid-state device, but I wish you the best of luck. But first, you really should try another card to be sure you don't have some other issue.

problem specification - request problem clarify

* Getting started with Linux <http://--->
* Booting and GRUB <http://---> *

"It's always something." --Emily Litella (Gilda Radner, 1946 - 1989)

06-07-08, 07:23 AM
#14
OP
Member

#14

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

Because I decided to send the card to the service, I thought I will try before some more invasive commands...

inquiry flow - parallel - report individual inquiry

```
# dosfsck /dev/sdd
dosfsck 2.11, 12 Mar 2005, FAT32, LFN
Currently, only 1 or 2 FATs are supported, not 255.

# fdisk /dev/sdd
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel with disk identifier 0x072f941d.
```

```
0495 Changes will remain in memory only, until you decide to write them.
0496 After that, of course, the previous content won't be recoverable.
0497
0498 Warning: invalid flag 0x0000 of partition table 4 will be corrected by
     w(rite)
0499
0500 Command (m for help): x
0501
0502 Expert command (m for help): p
0503
0504 Disk /dev/sdd: 17 heads, 59 sectors, 1020 cylinders
0505
0506 Nr AF Hd Sec Cyl Hd Sec Cyl Start Size ID
0507 1 00 0 0 0 0 0 0 0 0 00
0508 2 00 0 0 0 0 0 0 0 0 00
0509 3 00 0 0 0 0 0 0 0 0 00
0510 4 00 0 0 0 0 0 0 0 0 00
0511
0512 Expert command (m for help): v
0513 1023999 unallocated sectors
0514
0515 Expert command (m for help): q
0516
0517 ...while dosfsck sees 255 FATs, fdisk in expert mode shows that the
     partition table is empty. I decided to alternate the partition table...
0518
0519 # fdisk /dev/sdd
0520 Device contains neither a valid DOS partition table, nor Sun, SGI or
     OSF disklabel
0521 Building a new DOS disklabel with disk identifier 0xc77998e8.
0522 Changes will remain in memory only, until you decide to write them.
0523 After that, of course, the previous content won't be recoverable.
0524
0525 Warning: invalid flag 0x0000 of partition table 4 will be corrected by
     w(rite)
0526
0527 Command (m for help): w
0528 The partition table has been altered!
0529
0530 Calling ioctl() to re-read partition table.
0531 Syncing disks.
0532
0533 # fdisk -l /dev/sdd
0534
0535 Disk /dev/sdd: 524 MB, 524288000 bytes
0536 17 heads, 59 sectors/track, 1020 cylinders
0537 Units = cylinders of 1003 * 512 = 513536 bytes
0538 Disk identifier: 0x00000000
0539
0540 Disk /dev/sdd doesn't contain a valid partition table
0541
0542 ...before the disk identifier was 0xffffffff now it's 0x00000000. Fdisk
     was unable to set it to 0xc77998e8. Apparently there are some
     problems with reading and writing that card...
0543
0544 # ls /dev/sd*
0545 /dev/sda /dev/sdb /dev/sdc /dev/sdd
0546
0547 # dd if=/dev/sdd of=/root/xd.img
0548 dd: reading `/dev/sdd': Input/output error
0549 63968+0 records in
0550 63968+0 records out
```

32751616 bytes (33 MB) copied, 105.325 s, 311 kB/s

...I tried to use /dev/sdd becase there is no /dev/sdd1 in the system...

...dd can read about 32 MB of the entire 256 MB and ends with errors. The image contains almost exclusively the pattern of FFs with a few blocks of 00s inside (to see the image's content I used Midnight Commanders's F3 (View), F4 (Hex) options)...

The picture card mentioned above is logically completely dead. The only hope is in physical methods of restoring data.

problem diagnostic - interpret experiment/exp

As I said in the beginning: ``My picture card was good before I removed it from my camera and something wrong happened when I attached it to my machine and tried to mount it in my new system. Now it's useless".

Last edited by OP; 06-07-08 at 08:48 AM..

06-07-08, 08:14 AM
#15
#15
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

Appendix

Just for your in knowledge I repeated the same set of the commands with some CompactFlash digital memory card (1024 MB) to show you how should look the output of these commands with the unbroken card (that card is inserted in the sda slot of the reader)...

inquiry flow - parallel - report individual inquiry

```
# dosfsck /dev/sda
dosfsck 2.11, 12 Mar 2005, FAT32, LFN
Logical sector size is zero.

# fdisk /dev/sda

The number of cylinders for this disk is set to 1986.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
(e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): x

Expert command (m for help): p

Disk /dev/sda: 16 heads, 63 sectors, 1986 cylinders

Nr AF Hd Sec Cyl Hd Sec Cyl Start Size ID
1 80 1 1 0 15 63 961 63 2001825 06
2 00 0 0 0 0 0 0 0 0 00
3 00 0 0 0 0 0 0 0 0 00
4 00 0 0 0 0 0 0 0 0 00
```

```
0602
0603 Expert command (m for help): v
0604 62 unallocated sectors
0605
0606 Expert command (m for help): q
0607
0608 # fdisk -l /dev/sda
0609
0610 Disk /dev/sda: 1024 MB, 1024966656 bytes
0611 16 heads, 63 sectors/track, 1986 cylinders
0612 Units = cylinders of 1008 * 512 = 516096 bytes
0613 Disk identifier: 0x00000000
0614
0615 Device Boot Start End Blocks Id System
0616 /dev/sda1 * 1 1986 1000912+ 6 FAT16
0617
0618 # ls /dev/sd*
0619 /dev/sda /dev/sda1 /dev/sdb /dev/sdc /dev/sdd
0620
0621 # dd if=/dev/sda1 of=/root/cf.img
0622 2001825+0 records in
0623 2001825+0 records out
0624 1024934400 bytes (1.0 GB) copied, 149.339 s, 6.9 MB/s
0625
0626 ...I used /dev/sda1, because it exists and I'd like to mount the image
     in the file system...
0627
0628 # mount -o loop /root/cf.img /mnt/tmp/
0629
0630 ...now I mounted the image of the card in the system...
0631
0632 # ls -R /mnt/tmp/
0633 /mnt/tmp/:
0634 dcim
0635
0636 /mnt/tmp/dcim:
0637 196olymp
0638
0639 /mnt/tmp/dcim/196olymp:
0640 p6060530.jpg
0641
0642 ...and I can see there is one picture on that card...
0643
0644 # umount /mnt/tmp/
0645
0646 Remark: With the valid card the image of the device (for example
     /dev/sda) should be 32256 bytes greater than the image of the
     partition (for example /dev/sda1) -- the former contains some
     additional information at the beginning.
0647
0648 Last edited by OP; 06-07-08 at 09:16 AM..
0649
0650
0651  06-07-08, 08:18 AM
0652 #16
0653 P5
0654 Moderator
0655
0656 Registered: Nov 2005
0657 Location: Pasadena, CA
0658 Distribution: Mepis
0659 Posts: 12,065
```

problem specification - add detail/further expla

#16

Thanked: 177

Quote: dd can read about 32 MB of the entire 256 MB and ends with errors. The image contains almost exclusively the pattern of FFs with a few blocks of 00s inside...

turn-taking - partial qoute to denounce

Therefore, at least that portion has no pictures in it.

Again, if dd will not read the entire card, I know no other tricks.

inquiry disjustification - irreparable/no solution

---

* Getting started with Linux <http://--->
* Booting and GRUB <http://---> *

"It's always something." --Emily Litella (Gilda Radner, 1946 - 1989)

06-07-08, 09:21 AM

#17

#17

P6

Senior Member

Registered: Sep 2003
Distribution: mandriva 2009.1, 2008.1, kubuntu 8, fedora 8
Posts: 2,686
Thanked: 27

Try the noerror,sync options of dd. This will cause it to just keep reading when it finds an error, and it will pad the output file to accommodate those portions of the data that it couldn't read, thus retaining filesize and presumably boundaries etc.

response giving - provide - alternative solution

dd conv=noerror,sync if=/dev/sdd of=myoutfileimage bs=512

This WILL force the entire card to be read. Of course, you might just only have garbage there...

06-07-08, 10:22 AM

#18

#18

OP

Member

Registered: May 2008
Posts: 320
Thanked: 22

Original Poster

Quote: Originally Posted by P6
dd conv=noerror,sync if=/dev/sdd of=myoutfileimage bs=512

turn-taking - partial quote to designate respon

Thank you P6 for the valuable command.

appreciation - designated/specific~

Dd used with the above switch starts to read device without errors up to about 32 MB, then stops for a while, then starts to read large block claiming about errors, then stops for a while etc:

workability - report outcome - partial success~

dd: reading `/dev/sdd': Input/output error
63968+960030 records in
1023998+0 records out
524286976 bytes (524 MB) copied, 480.618 s, 1.1 MB/s
dd: reading `/dev/sdd': Input/output error
63968+960031 records in
1023999+0 records out
524287488 bytes (524 MB) copied, 480.618 s, 1.1 MB/s
63968+960032 records in
1024000+0 records out
524288000 bytes (524 MB) copied, 480.644 s, 1.1 MB/s

From the entire 512 MB it read about 512 MB of data in comparison to about 32 MB of output of dd used without any switches.

Final myoutfileimage contains first and foremost null data (the patterns of FFs). From time to time there are small parties of data. For example the first such party starts at offset 0x00030201 and ends at offset 0x00034002, the second starts at offset 0x003381ce and ends at offset 0x0033bfff etc. Before them and between them are the patterns of FFs.

No I go to buy some new xD picture card to test my camera and my card reader, and to compare valid card to invalid one.

inquiry flow - parallel - report individual inquiry

06-07-08, 10:51 AM
#19
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#19

I compared some garbage from the above image to a few valid dscf*.jpg pictures (photos taken with Fujifilm FinePix F30).

inquiry flow - parallel - report individual inquiry

The picture should start something like that:

ÿØÿà..JFIF.....ÿá'.Exif..II*..... .....¨.....

or something like that:

ÿØÿá'¾Exif..II*..... .....¨.....¸.....

The first party of garbage starts from:

ÿØÿá%~Exif..II*..... .....¨.....¸.....

(So it starts at the beginning of some picture but it is too short to include complete photo).

The second party of garbage starts from:

mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm
mmmmmmmmmmmmmmmmmmmmmmùG.¥.L"Üà.yÇaCÕ.Ô©v.?ÿ

(So it starts in random place and it is too short to include complete photo).

Etc.

Last edited by OP; 06-07-08 at 11:04 AM..

06-07-08, 11:21 AM
#20
P6___
Senior Member

Registered: Sep 2003
Distribution: mandriva 2009.1, 2008.1, kubuntu 8, fedora 8
Posts: 2,686
Thanked: 27

#20

You might also try it without the sync option. This will remove the output padding and the resulting filesize will be different than the input card size.

response giving - provide - alternative solution

You might get more useful information this way, and at a minimum you will know directly how much of the card is considered to be bad.

It would be very interesting if the bad section turns out to be a power of two in size; that would suggest a bad address line in the card (which might be repairable).

acknowledge - merit of proposed inquiry~

06-07-08, 03:24 PM
#21
OP___
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#21

I'm back here. I bought a new xD picture card. There is no in the market 512 MB cards so I was forced to buy 1 GB card.

Smaller cards are better than bigger ones. If small card fails you lose fewer pictures. The recovery of data from smaller cards is cheaper. So it's better to buy four small cards then one big one. Of course I don't take into the consideration the price, but remember: the price of the recovery of data by professional company is a few times higher than the price of the picture card.

inquiry flow - parallel - report individual inquiry

Well... My camera works. Mu card reader works. My new card works. So now I need to send my old card to some experts...

***

Thank you P6. for the next advice.

workability - report outcome - adequate succes

```
# dd conv=noerror if=/dev/sdd of=/rootmyoutfileimagewithoutsync
bs=512

dd: reading `/dev/sdd': Input/output error
127968+0 records in
127968+0 records out
65519616 bytes (66 MB) copied, 467.523 s, 140 kB/s
127968+0 records in
127968+0 records out
65519616 bytes (66 MB) copied, 467.571 s, 140 kB/s

# ls -l
-rw-r--r-- 1 root root 524288000 2008-06-07 16:00 myoutfileimage
-rw-r--r-- 1 root root 65519616 2008-06-07 19:07
myoutfileimagewithoutsync
```

524288000 - 65519616 = 458768384

It isn't a power of two (at least an integer power):

2 ^ 28 = 268435456
2 ^ 28.773190730622518 = 458768384
2 ^ 29 = 536870912

The content of myoutfileimage and myoutfileimagewithoutsync are similar: parties of garbage divided by patterns of FFs.

***

Wow!

***

And now real miracle...

0832
0833 I decided to try the command suggested by P6 at the beginning once again...

0834
0835 # dd conv=noerror,sync if=/dev/sdd of=mytwinoutfileimage bs=512
0836 1024000+0 records in
0837 1024000+0 records out
0838 524288000 bytes (524 MB) copied, 142.581 s, 3.7 MB/s

0839
0840 It ended work without errors!

0841
0842 # cmp myoutfileimage rmytwinoutfileimage
0843 myoutfileimage mytwinoutfileimage differ: byte 27137, line 1

0844
0845 An here's the content of mytwinoutfileimage, which in fact isn't the twin of myoutfileimage:

0846
0847 1. FFs from offset 0x00000000.
0848 2. Nice looking data starting a partition é..FF-DSC01.. .....ø}.?...5...K.....).....FAT16 .. etc. from offset 0x00006a00.
0849 3. Then various logically looking data.
0850 4. 00s from offset 0x0000ac2c.
0851 5. Then FFs, then 00s.
0852 6. Logically looking data from offset 0x00016600.
0853 7. 00s.
0854 8. Nice looking set of data including phrase .5.....100_FUJI ..d..
0855 9. 00s.
0856 10. Nice looking data such as .5.....DSCF2254JPG .dÆ.Â8Â8..Æ.Â8..¬J..DSCF2255JPG ..Ñ.Â8Â8..Ñ.Â8b.....DSCF2256JPG.
0857 11. 00s.
0858 12. The first picture ÿØÿá%~Exif..II*..... at offset 0x00030000.
0859 13. The consecutive pictures at offsets 0x001a8000, 0x0031c000, 0x00488000, 0x005ec000, 0x00754000, etc.

0860
0861 It's real miracle! I used the same command but the result isn't the same: myoutfileimage was full of FFs with small parties of garbage -- mytwinoutfileimage looks like the image of the device.

0862
0863 I do almost nothing between myoutfileimage and mytwinoutfileimage. In fact I do something. I used card reader with my new xD card. I can't find any other explanation of that miracle.

post-extend workability - confirm workability o

0864
0865 ***
0866
0867 # fdisk -l /dev/sdd
0868
0869 Disk /dev/sdd: 524 MB, 524288000 bytes
0870 17 heads, 59 sectors/track, 1020 cylinders
0871 Units = cylinders of 1003 * 512 = 513536 bytes
0872 Disk identifier: 0xffffffff
0873
0874 Disk /dev/sdd doesn't contain a valid partition table
0875
0876 Yes, of course, I know.
0877
0878 So I try that nice command for the third time...
0879
0880 # dd conv=noerror,sync if=/dev/sdd of=mytripletsoutfileimage bs=
512
0881
0882 dd: reading `/dev/sdd': Input/output error
0883 63968+960031 records in
0884 1023999+0 records out
0885 524287488 bytes (524 MB) copied, 471.287 s, 1.1 MB/s
0886 63968+960032 records in
0887 1024000+0 records out
0888 524288000 bytes (524 MB) copied, 471.31 s, 1.1 MB/s
0889
0890 Well... The miracle can happen only once...
0891
0892 I can't to explain it. I simply can't.
0893
0894 # cmp myoutfileimage mytripletsoutfileimage
0895 myoutfileimage mytripletsoutfileimage differ: byte 197122, line 1
0896
0897 How many times I run that command so many times it makes
different image. Strange...
0898
0899 ***
0900
0901 Now I will try to manage with pretty mytwinoutfileimage.
0902
0903 ***

post-extend workability - report error/limitatio

commitment - engage in continued problem sc

P6 you're a genius!

appreciation - compliment~

***

To be continued...

commitment - engage in continued problem sc

06-07-08, 04:33 PM
#22
P6
Senior Member

Registered: Sep 2003
Distribution: mandriva 2009.1, 2008.1, kubuntu 8, fedora 8
Posts: 2,686
Thanked: 27

#22

bad connection of the card to the device.

problem diagnostic - assertion/error point~

You plugged it in one time and it worked, but it is erratic. You might try cleaning the contacts, or you might just accept that you did get a good dump and go with that, and scrap out that card.

response giving - provide - solution b/conjectu

06-07-08, 05:47 PM
#23
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#23

I removed 27136 bytes of data from the beginning of mytwinoutfileimage, mounted the remain in the file system, and copied 91 photos to hard disk. Bingo!

workability - report outcome - adequate succes

Not all photos are pretty. 1 displays nothing (that file starts with a block of FFs); 3 have at the edge narrow stripe cut up from the same photo (it's possible to frame them); 7 have more or less wide gray stripe and sometimes additional geometrical distortions (it's impossible to frame them in a reasonable way); 6 have geometrical distortions (they look like cut up into rectangles and stripes, and puzzled together in a strange way); 74 are pretty.

In total: 81% of pretty photos, 3% usable after framing, 6.5% usable if you like strange effects, 8.5% unusable. Good result assuming a few hour ago I had nothing.

I don't think that problem is caused by dirty contacts. My old picture card is clean and my old card reader reads my new card without problems. I think it's a kind of undeterministic bug in my old card. I will try to create a few mytoutfileimages to see the results.

response taking - decline - no-novelty/irrelevar

The facts: my old picture card has invalid partition table; in most of cases my card reader can't read entirely my old picture card without errors; if it read it some photos are invalid.

problem specification - add detail/further expla

Thank you very much for your assistance, P6.

appreciation - designated/specific~

06-07-08, 06:25 PM
#24
OP
Member

#24

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

Well... After a few attempts (between 5 and 10) dd made the second usable image of that drive -- it's a twin brother of mytwinoutfileimage.

Good news: that six pictures with geometrical distortions can be edited and corrected in GIMP. I think it will take between one and two hours of work.

So 9% can be corrected in GIMP. It means 90% are recovered. Very good result.

post-extend workability - confirm workability o

Last edited by OP; 06-07-08 at 06:41 PM..

06-08-08, 06:09 PM
#25
P5
Moderator

#25

Registered: Nov 2005
Location: Pasadena, CA
Distribution: Mepis
Posts: 12,065
Thanked: 177

I am totally impressed how you stuck with this. Do you realize the percentage that give up at the first roadblock?

encourage - acknowledge (partial/complete) pr

So we can all sleep better, please assure us that you won't try to use that card in your camera again. Flash memory simply goes bad after a while, and no amount of tweaking or formatting will change that.

response giving - help - preemptive/additional

* Getting started with Linux <http://--->
* Booting and GRUB <http://---> *

"It's always something." --Emily Litella (Gilda Radner, 1946 - 1989)

06-08-08, 07:32 PM
#26 — #26
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

I took that night the pictures of a few persons. I felt obliged to do everything I could to recover that photos -- not for me but for them. — acknowledge - merit of proposed inquiry~

That particular picture card is logically almost dead. I don't intend to use it for any other purpose than some tests. — response validation - support other - agree/cor

Thank you all guys for your assistance. Every your tip, every your hint was valuable. Thank you very much. — appreciation - designated/specific~

Last edited by OP; 06-08-08 at 07:36 PM..

06-08-08, 08:00 PM
#27 — #27
P6
Senior Member

Registered: Sep 2003
Distribution: mandriva 2009.1, 2008.1, kubuntu 8, fedora 8
Posts: 2,686
Thanked: 27

Sometimes persistence pays. I have had to do things like this sometimes to recover stuff off of a dead hard drive. I once found one that would work if I stood it on edge, but not if I laid it flat. Whatever works. Glad this worked out for you. — encourage - acknowledge (partial/complete) pr

06-09-08, 07:07 AM
#28 — #28
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

I just called Ontrack Data Recovery department in my country. The standard procedure takes a few days. Expert analysis costs 40 USD; recovering of the data costs from 180 to 550 USD.

The picture card can be damaged logically or physically.

As I said above there is no 512 MB xD picture cards on the market. The price of 1 GB xD picture card is 27 USD. — inquiry flow - parallel - report individual inquiry

06-09-08, 11:57 AM
#29 — #29
P6

Senior Member

Registered: Sep 2003
Distribution: mandriva 2009.1, 2008.1, kubuntu 8, fedora 8
Posts: 2,686
Thanked: 27

Your card is damaged physically. The symptoms make that absolutely clear, and
if the damage was logical then dd would have extracted everything for you.

problem diagnostic - assertion/error point~
inquiry disjustification - irreparable/no solution

06-09-08, 02:27 PM
#30
OP
Member

#30

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

Quote: Originally Posted by **OP**
The picture card can be damaged logically or physically.

turn-taking - self-partial quote

The above general remark about picture cards I referred to pixellany, who wrote in #13:

response validation - correction - other's misur

Quote: Originally Posted by **P5**
I don't know what "hardware repair" you have in mind for a solid-state device, but I wish you the best of luck.

turn-taking - partial quote to support other sta

He was doubt the picture card can be physically damaged. I asked the guys from Ontrack and they said it can.

response giving - provide - answer/details on r

***
As for my picture card I thought so far it's logically damaged, because I could read data using software methods. Now I think you're right, jiml8. It explains strange, non-logical behavior of that card.

response taking - accept/agree~

Last edited by OP; 06-09-08 at 02:48 PM..

06-15-08, 04:41 PM
#31
P7
Member

#31

Registered: Nov 2002
Location: Italy
Distribution: Debian Etch
Posts: 249
Thanked: 0

I read this thread now.

I would try also gnu ddrescue, that should ignore errors and will keep reading.

response giving - provide - competing solution

ex:
ddrescue /dev/sdd ~/ddrescueimage.img log.txt

And also, if you still have the xd, have you tried to put your card in the freezer before trying to make an image of it? Sometimes works with hard disks...

Also foremost is sometimes useful to recover data from images created with dd or ddrescue.

Last edited by P7; 06-15-08 at 04:43 PM..

06-16-08, 10:43 AM
#32
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#32

Thank you P7 for an interesting hint.
I put that invalid picture card in a freezer for one hour and then I tried to read the image of it with dd. It produced small, 32 MB in size file full of FFs with some tiny fragments of the data. Freezing was pointless in that case but it doesn't mean it will be pointless in any other case.

Then I tried dd_rescue for two times. In reverse mode it produced the file of 524288000 bytes (512 MB) with short logfile reporting none errors. In forward mode it produced the file of 32768000 bytes (32 MB) with huge logfile reporting a lot of errors. Both these image files consisted from the large patterns of FFs separated from time to time with small chunks of some data.

Finally I tried GNU ddrescue in the default mode. It produced the file of 32751616 bytes (32 MB) and reported two errors in the logfile. The image made by GNU ddrescue was similar to the images produced by dd and dd_rescue: a lot of FFs and some data from time to time.

appreciation - designated/specific~
workability - report outcome - ineffective~

Last edited by OP; 06-16-08 at 10:59 AM..

06-16-08, 12:21 PM
#33
P7
Member

Registered: Nov 2002
Location: Italy
Distribution: Debian Etch
Posts: 249
Thanked: 0

#33

Sorry if nothing good happened, but better to try than not to try.

Trying to work with photorec and foremost on the right image could also lead to nothing, but even 1 more photo could be interesting...

acknowledge - merit of proposed inquiry~

06-16-08, 06:23 PM
#34
OP
Member

Registered: May 2008
Posts: 320
Thanked: 22
Original Poster

#34

All the hints are valuable. Thanks to them
I tried stubbornly to gain the image of that device and I finally succeeded. I recovered 84% of the pictures. Different tips described in that thread can be useful for other guys in the future. The trick with vertically positioned hard drive is interesting as well as the trick with deep-frozen hard drive.

appreciation - general~
encourage - acknowledge (partial/complete) pr

04-20-09, 11:32 AM
#35
P8
LQ Newbie

Registered: Oct 2005
Location: Rochester,Kent
Posts: 2
Thanked: 0

#35

Ubuntu and FinePix S9600

title (thread) - problem alignment

Fuji FinePix S9600 filesystem problem
I have scanned the thread- and my problem is similar if a little different.

problem consolidation(alignment) - solicit solut

I use Hardy and the Fuji camera. It has a 2G xD card which shows up on desktop as 565.3 MB Media with a usb symbol in its icon. Over the last 18 months I have copied about 5000 images from here , by opening that folder and select and dragging them to named folders on Desktop.

Last Sunday, I repeated the process. It started and after downloading 471 of 608 it stopped and reported an 200 I/O error. I tried the process on a Windoze machine and it stopped at the same point. I didn't panic- I know that on Linux this is a challenge not a problem. I unplugged the camera and saw one of the missing photos- in fact I can see all of the photos on the camera, and even take more.

problem specification - symptom - describe ob

So it looks if the camera is blissfully working using its own OS, but

inquiry justification - problem occurence/unprc

the VFAT directory corrupts on image 472. So it looks if the first few byte of the card are blown- I must have been working them too hard.

I have fiddled around with dd fsck testdisk with zero success. I have bought a Mikomi 56-1 reader in case that helps but I really need a working xD so I can check that it is working. Though a reboot suggests it can be seen. The new 1 Gig cards are working fine so now is the time to try again.

inquiry justification - prior effort~

I need some heavy duty hints on how to find the drive. How to use the tools to recover the remaining images or the last 125 or so. And like the card my memory function isn't a reliable as it was when I first used a Unix terminal 20 years ago. So don't omit the basics.

inquiry flow - request help - specific needs/des

07-11-09, 08:47 PM
#36
P9
LQ Newbie

#36

Registered: Apr 2005
Location: Maui - Hawaii
Distribution: Fedora 2 - soon Fedora 3
Posts: 12
Thanked: 1

Hi all, this is grumpy guy.I have an Olympus Stylus 770 SW which of course uses the notorious xD-Picture card - M-XD1GM. (Why I just lately unpacked the camera, uw case, etc. is another tale) In hindsight the card reader problem may be more important that the UW photo qualities. The camera is useless to me if I can't upload the photos to a Linux computer and use the Gimp for further work. I run Fedora 9 on three computers in the Philippines. I have been Microsoft free for 10 years and I have no intention of subjecting myself to the power/control policies of the windows folks.

problem consolidation(alignment) - solicit solut

I keep reading all these horror stories about card reader/card problems.

inquiry justification - prior effort~

Can any one point me in the direction of a multi-card reader that works with this card AND Linux.. Even sarcastic responses may have value.

inquiry flow - request help - specific needs/des

Thank you much,

appreciation - designated/specific~

07-12-09, 02:55 PM
#37
OP
Member

#37

Registered: May 2008
Posts: 320
Thanked: 22

Original Poster

I suppose every card reader should work. I use cheap hama's USB 2.0 Card Reader 35 in 1. It works perfectly. The problem discussed above concerned spoiled picture card and had nothing to do with the card reader.

inquiry flow - coordinate - exclude irrelevant cc

Thread 2: Partial Closure

Page: 1/5

001 Flowcomposer updateAllControllers Error... — OP - title - problem topic~

002

003 OP 17 posts since

004 Sep 5, 2010

005

006 Hello Forum, — greeting~

007 I get Error #1009 when I'm calling flowcomposer.updateAllControllers of my textflow AND — OP - problem description - specific context~

008 the text is too big to fit in my container...

009 TypeError: Error #1009: Cannot access a property or method of a null object reference. — OP - problem symptom - raw data~

010 at flashx.textLayout.compose::BaseCompose/parcelHasChanged()

011 at flashx.textLayout.compose::BaseCompose/advanceToNextParcel()

012 at flashx.textLayout.compose::BaseCompose/fitLineToParcel()

013 at flashx.textLayout.compose::ComposeState/composeNextLine()

014 at flashx.textLayout.compose::BaseCompose/composeParagraphElementIntoLin es()

015 at flashx.textLayout.compose::BaseCompose/composeParagraphElement()

016 at flashx.textLayout.compose::ComposeState/composeParagraphElement()

017 at flashx.textLayout.compose::BaseCompose/composeBlockElement()

018 at flashx.textLayout.compose::BaseCompose/composeInternal()

019 at flashx.textLayout.compose::ComposeState/composeInternal()

020 at flashx.textLayout.compose::BaseCompose/composeTextFlow()

021 at flashx.textLayout.compose::ComposeState/composeTextFlow()

022 at flashx.textLayout.compose::StandardFlowComposer/http://ns.adobe.com/textLayout/

023 internal/2008::callTheComposer()

024 at flashx.textLayout.compose::StandardFlowComposer/internalCompose()

025 at flashx.textLayout.compose::StandardFlowComposer/updateToController()

026 at flashx.textLayout.compose::StandardFlowComposer/updateAllControllers( )
027 Flowcomposer updateAllControllers Error...
028
029 Does anyone know why I get this error? — OP - solicit help/attention - general~
030 My solution now is to just ignore the error with a try and catch...it works, but I don't like it.... — OP - inquiry justification - prior efforts/invalid sea
031
032 P1 *205 posts since*
033 *Nov 21, 2008*
034 1.
035 Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 1:22 PM
036
037 Could you give us some more information? I haven't been able to reproduce that error. I'm — problem specification - request problem specifyi
038 assuming you're using TLF 2.0 (because of the callTheComposer call in the stack). What
039 kind of changes are you making before you call updateAllControllers?
040
041 OP *17 posts since*
042 *Sep 5, 2010*
043 2. Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 2:02 PM
044 in response to: P1
045
046 Yes, I'm working in tlf 2.0. — problem specification - provide requested proble
047 And I'm making a lot of changes (I tried to reproduce the error in a small test, and also
048 couldn't reproduce it...).
049 I set the format of a ContainerController
050 I add the ContainerController to a TextFlow (with flowComposer.addController)
051 I set the format of a ParagraphElement (which is attached to the TextFlow with addChild), i
052 set the format of spanElement (which is attached to the ParagraphElement with addChild),
053 then i add text to the spanElement.
054 Then I call flowComposer.updateAllControllers of the TextFlow
055
056 The example where I get the error concerns one line of text and the line does not fit into the — problem specification - add detail/further explan
057 ContainerController because the fontSize of this line is too big.
058
059 OP *17 posts since*
060 *Sep 5, 2010*
061 3. Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 2:05 PM
062 in response to: P1
063
064 the line is in Arial Regular with font size 72... — problem specification - add detail/further explan
065 Flowcomposer updateAllControllers Error...

P1 *205 posts since*
Nov 21, 2008
4. Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 2:28 PM
in response to: OP

What formatting are you applying to the ContainerController? — problem specification - request problem specifyi

OP *17 posts since*
Sep 5, 2010 5. Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 3:47 PM
in response to: P1

I'm setting verticalScrollPolicy and horizontalScrollPolicy
And setting columnCount, columnGap, paddingTop, paddingRight, paddingBottom,
paddingLeft, verticalAlign, firstBaselineOffset through format. — problem specification - provide requested proble

Could the problem be that I'm calling flowComposer.updateAllControllers() at the wrong time? — response taking - request - confimration on own

OP *17 posts since*
Sep 5, 2010
6. Re: Flowcomposer updateAllControllers Error #1009 Sep 7, 2010 4:26 PM
in response to: OP

Oh, yes, I don't know if this is helpful to know... I recently ported the apllication to tlf 2.0.
Before that I worked in the Max preview build, and in that version I did not get the error. — problem specification - add detail/further explan

P1 *205 posts since*
Nov 21, 2008 7. Re: Flowcomposer updateAllControllers Error #1009 Sep 8, 2010 3:47 PM
in response to: OP

From what you describe it sounds like you are calling updateAllControllers at the appropriate
point. — response giving - help - address/confirm other's

I'm assuming you're setting the scroll policies to "off" and that none of the text fits into
the first (and only) container. — problem diagnostic - conjecture~

But I still haven't been able to reproduce the error. Do you have code you could send us
(simple or complicated) that reproduces the error for you?
Flowcomposer updateAllControllers Error... — problem specification - request problem specifyi

P1 *205 posts since*
Nov 21, 2008
8. Re: Flowcomposer updateAllControllers Error #1009 Sep 8, 2010 4:14 PM
in response to: P1

Robin tells me this may be a bug that was recently fixed. I just uploaded a new build on SourceForge:
https://sourceforge.net/downloads/tlf.adobe/latest/
Could you try it out and see if this fixes the problem?

response giving - provide - solution b/conjecture

workability - request output detail~

OP *17 posts since Sep 5, 2010*
9. Re: Flowcomposer updateAllControllers Error #1009 Sep 9, 2010 5:16 AM
in response to: P1

Hello
P1,
Yes! Thanks a lot, the update did produce any errors anymore! (How often do you update?)
greetings, OP
p.s. I discovered another little stange thing about updateAllControllers, which is of no concern to my program, but are you interested to know?

greeting~

turn-taking - designate response by name

workability - report outcome - adequate success

inquiry flow - coordinate - introduce/add anothe

P1 *205 posts since Nov 21, 2008*
10. Re: Flowcomposer updateAllControllers Error #1009 Sep 10, 2010 6:01 PM
in response to: OP

We're working on getting our SourceForge updates automated. For now it's an ad-hoc manual process.
I am interested in whatever you've found about updateAllControllers - please post details.
Flowcomposer updateAllControllers Error...

potential irrelevancy/limitation~

engage in continued problem solving effort~

OP *17 posts since Sep 5, 2010* 11. Re: Flowcomposer updateAllControllers Error #1009 Sep 12, 2010 1:43 PM
in response to: P1

O.k.! I was making a small test to try and reproduce the error:

problem specification - symptom - raw data~

```
package {
import flash.display.Sprite;
import flashx.textLayout.formats.TextLayoutFormat;
import flashx.textLayout.container.ContainerController;
import flashx.textLayout.elements.ParagraphElement;
import flashx.textLayout.elements.SpanElement;
import flashx.textLayout.elements.TextFlow;
public class Test extends Sprite
{
public function Test() {
var tekstLayoutFormat:TextLayoutFormat = new TextLayoutFormat();
var cs:Sprite = new Sprite();
addChild(cs);
```

```
var textFlow:TextFlow = new TextFlow();
textFlow.format = tekstLayoutFormat;
textFlow.flowComposer.addController(new
ContainerController(cs, 400, 10));
// textFlow.flowComposer.updateAllControllers();
var paragraphElement = new ParagraphElement();
var spanElement = new SpanElement();
spanElement.text = "sdgfsd";
spanElement.fontSize = 70;
paragraphElement.addChild(spanElement);
Flowcomposer updateAllControllers Error...

textFlow.addChild(paragraphElement);
textFlow.flowComposer.updateAllControllers();
}
}
}
i get this result:
but when I call textFlow.flowComposer.updateAllControllers
(); twice (also earlier in the testprogram),
i get this result:
Flowcomposer updateAllControllers Error...

Why is there a difference?                                   inquiry flow - request help - specific needs/desire

P2 602 posts since
Jun 6, 2008
12. Re: Flowcomposer updateAllControllers Error #1009 Sep
14, 2010 10:18 AM
in response to: OP

I think it may be scrolling. Check verticalScrollPosition on the   response giving - provide - solution b/conjecture
ContainerController.
P2

OP 17 posts since
Sep 5, 2010
13. Re: Flowcomposer updateAllControllers Error #1009 Sep
14, 2010 12:51 PM
in response to: P2

I think you are right. When I set the ScrollPolicies off, the      workability - report outcome - adequate success
problem is gone.
Still... isn't it strange that it is scrolling? (Like I said, it is of no   post-extend workability - attempt to extend work
concern to my program, just
reporting this, so don't spent anymore time on this problem if
you don't feel like it...)
```

Thread 3: Non Closure

Page: 1/7

001
002
003 OP
004 Posts: 165
005 Registered: 2/14/07
006 Forum Points: 22
007 Posted: Aug 3, 2009 9:13 AM
008
009 **Managing attachments on ABAP Webdynpro launched from UWL**] OP - title - problem topic~
010
Hi All,] greeting~
011 I want to attch some files on ABAP webdynpro and send the same to R/3 Workflow.] OP - inquiry objectives/desideratum
012 I want again to get the same from Workflow container and show as link
013 on ABAP Webdynpro.
014 Thanks
015 OP
016

1 P1
017 **Re: Managing attachments on ABAP Webdynpro launched**
018 **from UWL**
019 Posted: Aug 3, 2009 9:23 AM in response to: OP
020
021 I think this has been discussed in this forum. Please search the forum.] inquiry norm - inadequate prior effo
022
023 Thanks
024
025 2
026 OP
027 Posts: 165
028 Registered: 2/14/07
029 Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from
030 **UWL**
031 Posted: Aug 3, 2009 9:28 AM in response to: P1
032
033 Hi
034 I didnt find any.] greeting~
035 Can you please post the link ?] inquiry justification - prior effort~
036 Thanks] response taking - request detail/exp
037
038 3
039 P2
040 Posts: 1,123
041 Registered: 8/17/07
042 Forum Points: 878
043 **Re: Managing attachments on ABAP Webdynpro launched from**
044 **UWL**
045 Posted: Aug 3, 2009 9:37 AM in response to: OP
046
047 Hi
048 OP
049] greeting~
050 You no need do any extra work to get the attachment in portal. Once if] turn-taking - designate response by
the attachment is done correctly and able to see the attachment in R/3] response giving - support own gen
the same attachment will come as link in UWL.

I want to know how you are triggering the workflow from Portal webdynpro abap its either a std screen or with custom screen.
If your are using custom screen use this FM to trigger the workflow **SAP_WAPI_START_WORKFLOW**. For the attachment use FM SAP_WAPI_ATTACHMENT_ADD.

problem specification - request prot
response giving - provide - competi

Regards
P2

4
OP
Posts: 165
Registered: 2/14/07
Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 9:45 AM in response to: P2

P2,
The manage attachment option in any workitem in UWL gives the option to attach files
and those are automatically sent to the workflow. They are also automatically available in the
next task of the workflow.

turn-taking - designate response by
response taking - decline - no-novel

But, my requirement is to show this "add attachment" option on the Dynpro that I am launching from UWL and not on the workitem, reason being that if the user has to attach before he or she submits the form on webdynpro.

Hence, I want the option on the form or webdynpro itself so that all attachements are shown in a table control.

inquiry flow - coordinate - repeat in

Thanks
OP

5
P2
Posts: 1,123
Registered: 8/17/07
Forum Points: 878
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 10:48 AM in response to: OP

Hi
In your webdynpro screen you have to write the logic for attaching the form. Use this class **CL_WD_FILE_DOWNLOAD** and **CL_WD_FILE_upload**. On the click of event you write the logic with the use of this class. SAme content pass to work item container using the FM **SAP_WAPI_WRITE_CONTAINER** . This way u can do it.

greeting~
response giving - provide - assertior

Regards
P2

6
OP

Posts: 165
Registered: 2/14/07
Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 11:46 AM in response to: P2

Hi All,
I added a UI element to my view of type Upload. Now on the button click I have a method where I am doing the following.
1) Get the Context attribute - XSTRING format
2) Now pass the XSTRING to SAP_WAPI_ATTACHMENT_ADD
It is not passing the attachment to Workflow container. I am passing the workflow work item ID and hence there is no binding involved.
Please suggest where am I wrong.
Thanks
OP

greeting~
problem specification - provide requ
inquiry flow - solicit help - general~

7
P3
Posts: 3,806
Registered: 6/23/08
Forum Points: 5,652
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 11:50 AM in response to: OP

Check this code snippet

```
lv_header-file type = 'B'.
lv_header-file name = 'Candidate Attachment'.
lv_header-file extension = 'DOC'.
lv_header-language = 'EN'.
CALL FUNCTION 'SAP_WAPI_ATTACHMENT_ADD'
EXPORTING
workitem_id = wf_wi_id
att_header = lv_header
att_bin = lv_xstring
IMPORTING
return_code = lv_return
att_id = att_id.
IF lv_return = 0.
lv_objtkey = att_id-doc_id.
lv_objsofm = 'SOFM'.
swc0_create_object bo_sofm lv_objsofm lv_objtkey.
ENDIF. " IF lv_return = 0
```

response giving - provide - solution

8
OP
Posts: 165
Registered: 2/14/07
Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 12:22 PM in response to: P3

P3,
I dont think I can use these macros in ABAP WebDynpro...As we can

turn-taking - designate response by
response taking - decline - limited a

not define CNTN01 in OO.
Please suggest. — inquiry flow - solicit help - general~

Thanks
OP

9
P2
Posts: 1,123
Registered: 8/17/07
Forum Points: 878
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 12:37 PM in response to: OP

Hi — greeting~
you cannot directly attach the attachment to the workitem from the webdynpro. 1st you pass to attachment to the FM **SAP_WAPI_WRITE_CONTAINER** then you do this in workflow side, in the BOR method pass this container element details to the FM **SAP_WAPI_ATTACHMENT_ADD**. Now this should work. For testing purpose u directly hardcode the work id and check in the WDA side. Just give a try!!!!!!!!! — response giving - help - follw-up otl

You can also follow the pavan's method as your saying that CNTN01 cannot use in OO. use create a custom Fm in the FM write the attachment logic and call that FM in your WDA. This will solve your purpose. If you still want to use without custom FM you need to change the macro name not CNTN01 but different name. Ask pavan he know it. Even he has replied to some one with similary query. Search forum with pavan name. surly u will get the answer. — response giving - help - follw-up otl

Regards
P2

10
P3
Posts: 3,806
Registered: 6/23/08
Forum Points: 5,652
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 12:39 PM in response to: OP

Yes I accept with you that you cannot use Include <CNTN01> but you can use **INCLUDE CNTN01_SWC** as Iam also using this include in a class global data. — response giving - provide - alternati

11
OP
Posts: 165
Registered: 2/14/07
Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 1:53 PM in response to: P3

Hi All,

greeting~

I got the attachment in my Workflow container without using the macros.

workability - report outcome - adeq

Is that ok or ambiguous ?

post-extend workability - limited wo

Thanks
OP

12
P3
Posts: 3,806
Registered: 6/23/08
Forum Points: 5,652
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 3, 2009 1:59 PM in response to: OP

Iam not sure what are talking about?, if you are able to pass the attachment to the workflow then all you have to do is now pass do binding between the task to which you want to attach

response validation - correction - ot

13
OP
Posts: 165
Registered: 2/14/07
Forum Points: 22
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Aug 5, 2009 12:00 PM in response to: P3

POOOO,

14
P4
Posts: 28
Registered: 6/30/08
Forum Points: 0
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Nov 10, 2009 8:21 AM in response to: OP

Hi,

greeting~

Request you to please let me know how to passed an attachment to the workflow container.

problem specification - request prob

Thanks & Regards,
P4

15
P5
Posts: 4
Registered: 3/8/10
Forum Points: 0
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Mar 12, 2010 1:14 AM in response to: P4

Any solution please.I have the same issue. problem consolidation(alignment) -
Thanks,
P5

16
P6
Posts: 2,609
Registered: 11/22/08
Forum Points: 3,074
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Mar 12, 2010 5:25 AM in response to: P5

Hello, greeting~
Please open a new thread. inquiry flow - close - suggest to star
What have you tried? problem specification - request prot
Did SAP_WAPI_ATTACHMENT_ADD not work for you?
regards
P6

17
P7
Posts: 76
Registered: 10/24/05
Forum Points: 16
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Mar 15, 2010 4:27 PM in response to: P6

I added the attachment using the following code from my webdynpro abap application: problem specification - provide requ

```
DATA: lv_xstring TYPE xstring,
att_id TYPE swr_att_id,
ls_msg_ln TYPE TABLE OF swr_messag,
ls_msg_str TYPE TABLE OF swr_mstruc,
lv_objkey TYPE swr_att_doc_id,
ls_header TYPE swr_att_header.
lv_xstring = lv_file.
ls_header-file_type = 'B'.
ls_header-file_name = 'Attachment'.
ls_header-language = sy-langu.
CALL FUNCTION 'SAP_WAPI_ATTACHMENT_ADD'
EXPORTING
workitem_id = lv_wi_id
att_header = ls_header
att_bin = lv_xstring
do_commit = 'X'
IMPORTING
return_code = rc
att_id = att_id
TABLES
message_lines = ls_msg_ln
message_struct = ls_msg_str .
```

I see the attachments in the workitem but am unable to open the

attachment.

Another question is how can I show the same documents in another webdynpro application as attachments.

inquiry flow - coordinate - introduce

Thanks,
P7

18
P8

Posts: 76
Registered: 10/24/05
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Mar 15, 2010 4:34 PM in response to: P7

Opened new thread.

Thanks,

response validation - support other

19
P7
Posts: 76
Registered: 10/24/05
Forum Points: 16
Re: Managing attachments on ABAP Webdynpro launched from UWL
Posted: Mar 16, 2010 7:44 PM in response to: P6

Please suggest what was the solution?

Thanks,
P7

inquiry flow - request help - specific

Thread 4: Degraded Closure

Page: 1/17

001 07-10-09, 01:03 PM
002 **#1**
003 OP
004 Member
005
006 Registered: Jul 2004
007 Location: Dhaka, Bangladesh
008 Distribution: openSUSE 11, RHEL 5.x, CentOS 5.x, OpenSolaris
009 Posts: 177
010 Thanked: 0
011
012 **What is the recommended swap space for 32 bit Linux**] OP - title - opinionating~
013
014
015 I have a **32 bit** version of Linux (any distro) running with **4GB of RAM**.] OP - problem description - specific context~
016 What would be the **maximum recommended swap space**?] OP - inquiry objectives/desideratum~
017 _____
018 --
019 FAzle AreFin aka Th3 Gripmast3r
020 Choose your Linux Distro <http://www.zegeniestudios.net/ldc/index.php>
021 Heaven and Hell - Fairy Tale Retold
022
023 07-10-09, 01:21 PM
024 **#2**
025 P1
026 Guru
027
028 Registered: Dec 2005
029 Location: Somewhere on the String
030 Distribution: Debian Lenny (x86)
031 Posts: 5,040
032 Thanked: 70
033
034 Depends on what you are going to be doing.] response giving - provide - suggestion b/gener
035 If you're doing heavy video editing with your 4GB of RAM, I'd use another 4GB swap. If you're just doing general computing with some gaming and whatnot, you can probably get by with 1GB or less.
036 _____
037 Linux Distro Chooser <http://www.zegeniestudios.net/ldc/index.php>
038 Saikee's Grub Booting Tips <http://justlinux.com/forum/showthread.php?t=144295>
039 GParted LiveCD <http://gparted.sourceforge.net/livecd.php>
040 Linux Distro Timeline <http://www.kde-look.org/content/show.php?content=44218>
041
042 07-10-09, 01:35 PM
043 **#3**
044 OP
045 Member
046
047 Registered: Jul 2004

Location: Dhaka, Bangladesh
Distribution: openSUSE 11, RHEL 5.x, CentOS 5.x, OpenSolaris
Posts: 177
Thanked: 0

Original Poster

Quote: Originally Posted by **P1**
Depends on what you are going to be doing. If you're doing heavy video editing with your 4GB of RAM, I'd use another 4GB swap. If you're just doing general computing with some gaming and whatnot, you can probably get by with 1GB or less.

turn-taking - whole quote to designate respons

But anything over 4GB of swap space would be a waste, isn't it? As this is a 32 bit OS.

inquiry flow - coordinate - narrow down optic

FAzle AreFin aka Th3 Gripmast3r
Choose your Linux Distro
<http://www.zegeniestudios.net/ldc/>
Heaven and Hell - Fairy Tale Retold

07-10-09, 01:38 PM
#4
P2
Senior Member

Registered: Dec 2007
Posts: 1,286
Thanked: 100

Quote: Originally Posted by **P1**
Depends on what you are going to be doing.

turn-taking - partial quote to support other stat

Absolutely.

response validation - support other - agree/con

Quote: If you're doing heavy video editing with your 4GB of RAM, I'd use another 4GB swap.

turn-taking - partial quote to contradict

I don't understand that one. We're talking about 32 bit. "heavy" video editing is still likely to be just one big process. If there is only one big process you have no need for 4GB of swap on top of 4GB of ram.

response validation - denounce - irrelevance ar

Maybe you hope to leave some enormous video recompression task running in low priority all day while you intermittently use the system for other activities, so you think it can swap out when other tasks need that ram. Unfortunately, Linux doesn't really prioritize ram use, just CPU use. If that video recompression task needs its max 3GB of ram, it will probably make the whole system crawl even if you set its priority low and have room that it could have swapped out. If it

needs far less than 3GB of ram, then it didn't need the room to swap out. Either way 4GB of swap won't help it.

Quote: If you're just doing general computing with some gaming and whatnot, you can probably get by with 1GB or less. — turn-taking - partial quote to support other stat

I agree. — response validation - support other - agree/ ext

If you are running major background processes, such as multiple copies of a database server, or any long running low priority memory intensive tasks, you want enough swap space to let all the anonymous memory of all your background jobs get swapped out when you are running some big foreground job that should make better use of the ram for file caching.

Or maybe you plan to switch away from some monster spreadsheet in Open Office Calc (which is very wasteful of virtual memory) while you do some other task in the foreground (rather than close the spreadsheet and reopen it when you want to work on it again).

But there is no general rule. How should we have any clue what the total size of anonymous memory in all your background jobs is. — deflaming - acknowledge/open to diverse opini

You didn't give us any clue what background jobs you're even going to run. — inquiry norm - problematic manner (poor partic

With 4GB on a 32 bit system, we can be **pretty sure** the foreground task (whatever program you're actively using at any moment) doesn't need any swap space. Maybe you have a better guess what programs will be left open but inactive and how big they will be. — response giving - support own - general practic

Quote: Originally Posted by **OP**
But anything over 4GB of swap space would be a waste, isn't it? As this is a 32 bit OS. — turn-taking - partial quote to designate respons

I've read a lot of contradictory stuff about what swap space can be used (vs. you need multiple swap partitions instead of one big one). I'm not sure, but I think that whole issue is obsolete. I think even 32 bit Linux can use giant swap partitions if you leave enough large processes open (stalled unless you want the whole system to crawl) that you have some use for that swap space. — response giving - help - address/confirm other'

Last edited by P2; 07-10-09 at 01:55 PM..

07-12-09, 03:23 PM
#**5**
P3
Gentoo support team

Registered: May 2009

Location: 56N 3W
Distribution: Gentoo
Posts: 176
Thanked: 18

OP,

turn-taking - designate response by name

A 4G swap will allow you to hibernate to swap. You can't actually use 4G RAM on a 32 bit install, unless you use PAE, as some of it must be remapped above the BIOS, the memory mapped I/O space and the PCI space.
On many systems you loose about 800Mb.

As swap is only used for dynamically allocated RAM, if you don't need to hibernate, 1G should be plenty.
If you need that much swap, you really need a 64bit install and more RAM.

response validation - contradict - wrong assum

Regards,P3

Computer users fall into two groups:-
those that do backups
those that have never had a hard drive fail.

Gentoo Specific Forums <http://forums.gentoo.org>

07-12-09, 03:48 PM

#6

P4
Member

Registered: Sep 2003
Location: Kentucky
Distribution: FreeBSD
Posts: 397
Blog Entries:
<http://www.--->
Thanked: 1

I have 4 gigs of ram to. Drive space is so cheap nowadays and I always use 2.1 gigs for swap. This kinda puts me middle road and I actually have never touched that much swap.

problem consolidation(alignment) - suggest exp

Owner of govnut.com <http://--->.

07-12-09, 04:49 PM

#7

P5
LQ Newbie

Registered: Jul 2009
Posts: 3
Thanked: 0

157 **Max 2GB with 32 bits OS** — title (thread) - summary/emphasis
158
159 Hello!
160
161 I see the discussion above, and although I'm not sure about the swapspace, the problem is that a 32-bit OS can't address more than 2gb of memory, so there is not much use to have more than 2gb of memory unless you use a 64-bit OS. — response validation - support other - agree/ ext
162
163 Regards,
164
165 P5
166
167 07-12-09, 06:31 PM
168 #8
169 P6
170 Senior Member
171
172 Registered: Jul 2007
173 Location: Directly above centre of the earth, UK
174 Posts: 1,593
175 Thanked: 57
176
177 Quote: Originally Posted by **OP** — turn-taking - partial qoute to denounce
178 ... *the [b]maximum recommended swap space?*
179
180 That seems like an odd question; if I scour round the internet looking for odd recommendations I'm sure that I can find some that are insanely large; 32G or more. — inquiry disjustification - incorrect assumption/w
181
182 Under no circumstances would that seem like a good suggestion for an ordinary user, so I wouldn't recommend that you do it (but it would be the answer to the question that you asked, whether its what you wanted to know, or not). — response giving - hesitate - vague/tricky objecti
183
184 For the more normal case, 1 or 2 G would seem adequate (but, I'll repeat, just because it would be sensible in the normal case doesn't make it the answer to your question). — response giving - provide - answer/details on re
185
186 Suspend to disk seems to need more, but whether 4 G guarantees that it will work is possibly open; sensibly, I doubt it will fail.
187 *Quote: I think even 32 bit Linux can use giant swap partitions* — turn-taking - partial quote to designate respons
188
189 I'd like to see definitive information on this; I saw what purported to be definitive information, but on re-reading it carefully I couldn't make out whether it was only early kernels that had this limitation, or not. — response giving - hesitate - vague/tricky objecti
190 In any case, even if this does still apply, it only means that you have to use multiple swap partitions (...or files...) in order to get to the required size, which isn't much of a pain. Well, which isn't really a pain at all at install time, it may be a pain if — response giving - help - preemptive/additional i

you decide that you need more swap later, for some reason. In that case, one swap *partition* plus a swap *file* to meet he requirement?

191 *Quote: 32-bit OS can't address more than 2gb of memory, so there is not much use to have more than 2gb of memory unless you use a 64-bit OS.* — turn-taking - partial quote to designate respons

192

193 I can see what you are getting at, but you get the details wrong. — response validation - correction - other's misun

194 firstly, with a 32 bit address space, the limitation is, as was already stated, 4G minus some bits, which is usually around 3.2 G, not 2.

195

196 Additionally, there is PAE, which is a 32 bit system, and that can address way more than 4 G (but there is a limitation of a 4 G address space *per process*, which for most use cases for which 32 bit is in contention isn't a real limitation). Although I wouldn't suggest that PAE is a sensible solution for other than marginal cases around 4+ G, and I really suspect that you ought to be strongly considering a true 64 bit system if you want much more.

197

198 07-12-09, 11:08 PM
199 # 9
200 P7____
201 Guru
202
203 Registered: Jan 2002
204 Location: AZ
205 Distribution: Gentoo
206 Posts: 5,648
207 Thanked: 12
208

209 It seems everybody got the information about using 4 GB of RAM on a 32-bit OS and swap memory wrong. A 32-bit OS can handle 4 GB with out any problems. PAE comes in and takes the fun out of it, so close to a gigabyte of RAM is used to help address the memory. PAE is not necessary to handle 4 GB of RAM on a 32-bit setup. PAE is used to handle pass 4 GB of RAM, but PAE is not required for setups up to 4 GB of memory. Unfortunately, PAE can not be turned off. — response validation - contradict - false statemer

210

211 Swap memory can be any size. It has no limits of size and quantity. There are limits, but you will not ever get close to them. The size and quantity depends on the matter of preference and use. If you see that you need more swap, you can always add more by fly swapping. The advantages of a fixed swap memory size and fly swapping is a whole another topic. — response giving - provide - solution b/personal

212

213 My swap memory load with 2 GB of RAM is no more than 10 MB even during playing games. It might be a little more, but that is about it.

214

215 07-13-09, 08:33 AM

216 **#10**
217 P2
218 Senior Member
219
220 Registered: Dec 2007
221 Posts: 1,286
222 Thanked: 100
223
224 Quote: Originally Posted by **P7** — turn-taking - partial quote to contradict
225 *PAE comes in and takes the fun out of it,*
226
227 Meaning what? — response taking - request detail/explanation~
228 *Quote: so close to a gigabyte of RAM is used to help address the memory.*
229
230 ??
231
232 PAE (or 64 bit mode), at the hardware mapping level, requires more than one page of overhead per 512 pages used. (vs. non PAE 32 bit mode, which requires more than one page of overhead per 1024 pages used). — response validation - contradict - general practi
233
234 Normal memory use won't make optimal use of the mapping, so it may take significantly more than one per 512. Also the Linux kernel adds significant software data structures, I'm pretty sure those are at least as big as the hardware data structures, so overhead must exceed one page in 256.
235
236 But we're still talking a very small fraction of total ram dedicated to the mapping overhead. A gigabyte of overhead is an absurd estimate for any ordinary system.
237
238 There are also various kinds of time overhead in the mapping. The time overhead of PAE will be about double the time overhead of non PAE 32 bit, and the time overhead of 64 bit will be slightly higher than PAE. But again, we are talking about tiny numbers. Even though that overhead in 64 bit is more than double what it is in non PAE 32 bit, that difference is generally not noticeable, because the quantity being doubled started as a small fraction of one percent of total CPU time.
239 *Quote: PAE is not necessary to handle 4 GB of RAM on a 32-bit setup.* — turn-taking - partial quote to correct
240
241 False. Without PAE, a 32 bit kernel can use up to 3 point something GB of ram (the exact value depends on BIOS details, but 3.25GB is a common value). — response validation - contradict - false statemer
242 *Quote: PAE is used to handle pass 4 GB of RAM, but PAE is not required for setups up to 4 GB of memory.* — turn-taking - partial quote to contradict

PAE is needed to pass 4GB of physical address space. But 4GB of ram requires more than 4GB of physical address space.

response validation - contradict - false statemer

Quote: Unfortunately, PAE can not be turned off.

turn-taking - partial qoute to denounce

Meaning what?

response validation - contradict - general practi

A 32 bit Windows kernel can decide at load time whether to use PAE. If you want to turn PAE on or off (reverse what was chosen on the last boot) you need to reboot.

A 32 bit Linux kernel has that decision made at the time the kernel is built. If you want to turn PAE on and off, you need to have two different kernels and switch which one you select on reboot.

Most 32 bit copies of Windows have a license restriction to 4GB of physical address space, so even when you turn on PAE, you still get only 3 point something GB of ram.

PAE in Windows also enables execution protection, which is used to defend against certain kinds of malware. I'm not sure about that detail in Linux.

The type of malware that defends against **usually** depends on the user surfing the net with root privileges **and** on the user running exactly the build of the browser or some plug-in that the malware author designed for (vs. some recompile of open source done by some distribution maintainer). Those things are less likely to be true in Linux, so the malware would probably fail anyway, even in non PAE 32 bit.

Quote: My swap memory load with 2 GB of RAM is no more than 10 MB even during playing games. It might be a little more, but that is about it.

turn-taking - partial qoute to denounce

I don't think this thread is about swap or memory use on a typical system. The OP has at least implied it is about unusually high swap use.

inquiry flow - coordinate - exclude irrelevant co

It isn't surprising that your 2GB system is lightly loaded enough that it has no significant use of swap. But it also isn't relevant.

07-13-09, 05:48 PM
#11
P7
Guru

Registered: Jan 2002
Location: AZ
Distribution: Gentoo
Posts: 5,648

272 Thanked: 12
273
274 P2, for someone that is smart can be stupid like some others. — flaming - sarcasm~
275 PAE is used to address pass 4 GB of RAM. It is programmers counting for all the contingencies that users will do during upgrading their computer. An 80386 can handle 4 GB of physical RAM because the manual says so. Back before PAE is implemented and during the transition to PAE, some motherboard manufactures includes an option to completely turn off PAE. — response validation - contradict - false statemer
276
277 The reason why I said that using PAE takes the fun out of it is because basically it turns 4 GB and more of memory for 32-bit operating systems into virtual memory instead of physical memory. Physical memory and virtual memory are completely different. A computer accessing physical memory has no performance penalty while virtual memory has a performance penalty. Also virtual memory consumes memory for addressing. The penalty is caused by the addressing the memory. — response validation - contradict - general practi
278
279 The reason why I stated that close one gigabyte is used for PAE is actually the truth although if you want to get technical it is about 896 MB of RAM that is used. Since PAE turns physical RAM into virtual memory, it is basically 1 GB of RAM that you can not use. It makes it worst for every 4 GB of RAM that is installed. Also Linux is a virtual memory operating system, so two layers of virtual memory is used and this penalizes the computer. Linux virtual memory mapping is either 1 to 3, 2 to 2, and 1 to 3. This ratio is related to user space and kernel space. PAE only lets a 32-bit processor or a 32-bit operating system to use past 4 GB, but only in 4 GB chunks with a cost of flip-flopping between user space data and kernel or database data.
280
281 PAE has nothing do with protection. The protection that you are explaining about is the NX bit or Enhanced Virus Protection which double checks if the program will have buffer over flows. Hackers uses buffer over flows as one of their techniques to gain entrance into computers. This feature helps somewhat, but a real fix is better which will take a long time from the processor manufacture and programmer to implement. The NX bit is an easy work around for the many or several thousand bugs of 80x86. However the NX bit requires PAE because PAE provides information where data is stored. — response validation - contradict - wrong assum
282
283 About swap memory size and quantity is completely a matter of preference and use. A computer with 128 MB of RAM and using KDE as the desktop/window manager of choice, swap should be at the least double the amount of RAM. A computer with 4 GB of RAM and using KDE. Swap space is not necessary. I say start with around 256 MB of swap space for a setup that has 4 GB. If see that you need more, add swap space with fly swapping. If using a lot of fly swapping, then you have to re-think about your swap space size. Also — response giving - provide - suggestion b/gener

optimizing Linux's virtual memory settings can help reduce thrashing to swap space during use.

07-13-09, 06:39 PM
#12
P8
Senior Member

Registered: Nov 2006
Distribution: Debian Lenny 2.6.30.2 SMP
Posts: 2,542
Thanked: 41

Here's the wiki on PAE. NOTE that with PAE, "The x86 processor hardware is augmented with additional address lines used to select the additional memory, so physical address size is increased from 32 bits to 36 bits. This increases maximum physical memory size from 4 GB to 64 GB." That's 36 bits of addressing, not 64. There is a discussion of the differences in how the Page Table is used.

response validation - support other - agree/ ext

<http://en.wikipedia.org/wiki/Physical_Address_Extension>

response giving - support own- direct link/verify

07-13-09, 08:06 PM
#13
P2
Senior Member

Registered: Dec 2007
Posts: 1,286
Thanked: 100

Quote: Originally Posted by **P7**
for someone that is smart can be stupid like some others.

turn-taking - partial qoute to denounce

I didn't expect to convince you of anything.

flaming - uncompromising insistence~

I was bothered that the incorrect things you are saying would confuse other people reading this thread. I thought I should try to balance that.

flaming - false statement~

At least for this thread, we're way past the point of diminishing returns. My apologies to anyone who is reading this thread and wants the correct information and doesn't know which to believe.

deflaming - avoid ineffective debate/ off-focuse

I've read a bunch of your posts, where you are talking about things I'm interested in but don't really know, such as the "TDP" of CPUs. In those you really sound like you know what you are talking about. So first that makes me worry that to someone who doesn't know this topic, you will sound like you know what you're talking about and you'll spread a lot of confusion. Second I worry that I'm trusting you in those threads (obviously not this one) where it sounds to me like you know what you're talking about and I'm accepting

response validation - contradict - false statem

misinformation.

I disagree with almost everything in your last post, but it is obviously pointless to try to refute it detail by detail.

flaming - false statement~

Quote: Originally Posted by **P8**
his increases maximum physical memory size from 4 GB

turn-taking - partial qoute to denounce

Wikipedia is a great resource, very informative and usually correct. In this case it is unfortunate that someone chose to over simplify by using that phrase "physical memory size".

response validation - denounce - incorrect presi

People who actually put a full 4GB of ram in systems that only support 4GB of physical address space constantly ask why they can't use all their memory. All the places on the net that incorrectly say or imply you can use a full 4GB of ram without PAE are just confusing people. The bottom line, when you actually try it, is you can't. Some of your 4GB of ram must be either lost or mapped beyond the first 4GB of physical address space.

response validation - contradict - general practi

An x86 CPU manufacturer is free to say you can have a full 4GB of ram without PAE, because you could design a computer with that same CPU that can support a full 4GB of ram (if it does all its I/O some other way that doesn't tie up address space and it doesn't try to be compatible with any of the PC bus or bios standards). But no one would design such a computer and if they did, it wouldn't run Windows nor any existing Linux distribution. In PC compatible computers, a significant chunk of the first 4GB of physical address space must be tied up by things other than memory.

Last edited by P2; 07-13-09 at 08:34 PM..

07-13-09, 11:49 PM
#14
P8
Senior Member

Registered: Nov 2006
Distribution: Debian Lenny 2.6.30.2 SMP
Posts: 2,542
Thanked: 41

Quote: Wikipedia is a great resource, very informative and usually correct. In this case it is unfortunate that someone chose to over simplify by using that phrase "physical memory size".

turn-taking - partial qoute to denounce

Bad turn of phrase, I guess. I believe the point they're trying to make is that the physical memory footprint for 32 bits is 4GB, not that 4GB of RAM will be completely used.

response validation - correction - other's misun

To be honest, when I put in 4GB for the first time, it took me a while to realize that there was memory mapped IO and probably lots of other stuff I didn't think about that had to be accounted for and which was occupying a lot of that memory

problem consolidation(alignment) - diagnose

space. To further compound the issue, I had a memory mapped on-board video, and I still don't know for sure how that interacted with memory. The BIOS was configurable, but Linux, or perhaps the video chip, used something else.

It's all good, P2.

deflaming - acknowledge/open to diverse opi

07-14-09, 05:51 AM
#15
P7
Guru

Registered: Jan 2002
Location: AZ
Distribution: Gentoo
Posts: 5,648
Thanked: 12

P2, If you think I am providing misinformation of what I type than you are wrong.

flaming - false statement~

PAE or Physical Address Extension is basically virtual memory. Any 80x86 processor since 80386 has support for virtual memory. PAE works simply by dividing up memory into user space and system space. Since a 32-bit processor can only see 4 GB of RAM, PAE sets up as a viewer for the processor. PAE lets the processor view all installed memory by showing only 4 GB of RAM at a time, but at a price of taking up memory for logging user space memory into system space. The reason why I said that it can take up to 1 gigabyte of memory is related to the amount of hardware that the computer has connected. More hardware, more memory is being taken up.

PAE can be turned off by changing a certain register bit to off. Also PAE have to be turned off in software. Sure the NX bit will not work but do not need it if the system is running software that is not written sloppy which can cause buffer over flows.

Saying that an 32-bit x86 processor can not handle 4 GB of RAM with out any facts is completely wrong. A 32-bit x86 processor can handle 4 GB of RAM. The amount of memory used is dependent on the amount of hardware that is installed and drivers does not have to be loaded to see the effects. This happens on any setup.

TDP has no standard definition, so that is why it is confusing. Basically, TDP is a mean value spec which means no relation to true power total power consumption. A 65 watt TDP processor's true TDP can be close to 160 watts.

response validation - contradict - false statemer

07-14-09, 07:01 AM
#16
P6
Senior Member

Registered: Jul 2007
Location: Directly above centre of the earth, UK
Posts: 1,593
Thanked: 57

Apologies to the OP, but I think we have drifted some way off helping you, — deflaming - apology/preemptive excuse~

but there is some, err, misunderstanding or mis-expression, in this thread and I really don't like the idea of deceptive material hanging around. — flaming - false statement~

Quote: Originally Posted by **P7**
It seems everybody got the information about using 4 GB of RAM on a 32-bit OS and swap memory wrong. — turn-taking - partial qoute to denounce

It seems that you have taken in too much of that wrong stuff and chosen to believe it, or at least, recycle a somewhat distorted version of the truth.. — flaming - false statement~

Quote: A 32-bit OS can handle 4 GB with out any problems. PAE comes in and takes the fun out of it, so close to a gigabyte of RAM is used to help address the memory. — turn-taking - partial qoute to denounce

No. A 32 bit OS can handle a a 4G *address space*, but practically, within the PC architecture, when you take out the various holes for various bits and pieces of IO, you end up with being able to adress rather less memory than this. — response validation - contradict - false statemer

Quote: PAE is not necessary to handle 4GB of RAM on a 32-bit setup — turn-taking - partial quote for partial concessior

This would be true, if it weren't for the memory holes. But the memory holes are a significant part of the picture when you you get towards 4G of ram (and want to use as much of it as you can). — response validation - contradict - partial conces

Quote: Unfortunately, PAE can not be turned off. — turn-taking - partial quote to correct

Well, you can't turn it on and off dynamically, if that's what you mean (but its unclear why you would want to mean that, as no one has mentioned wanting to do this on a running system). But you can always choose not to use it (ie, use the non-PAE kernel) and put up with the 4G minus the memory holes. — response validation - contradict - partial conces

Quote: Swap memory can be any size. It has no limits of size and quantity. There are limits, but you will not ever get close to them. — turn-taking - partial quote to correct

according to the linux Partition howto <http://lissot.net/partition/index.html> you could have a limit of — response giving - support own- direct link/verif

2G per swap partition (or it could be 16T). That is arch dependant, and while we might agree that it would not be sane to get close to 16T, 2G (i386) is another matter. The document is a bit old by now ('05) and maybe things have changed in the latest kernels, but if the OP was running one of the more compact distros, intended for older hardware, this could be an issue.

response validation - contradict - wrong assump

396

397 *Quote: The reason why I stated that close one gigabyte is used for PAE is actually the truth*

turn-taking - partial qoute to denounce

398

PAE is not actually using the memory lost due to the holes.

response validation - contradict - false statemen

399

400 P2 has dealt with the problem of using, but, in fact, that is a poor expression: the problem is not so much *using* as *not using*. that is, losing due to holes, rather expending extra memory in page mapping.

response validation - support other - agree/ ext

401 *Quote: Since PAE turns physical RAM into virtual memory, it is basically 1 GB of RAM that you can not use.... It makes it worst for every 4 GB of RAM that is installed. Also Linux is a virtual memory operating system, so two layers of virtual memory is used and this penalizes the computer.*

turn-taking - partial quote to contradict

402

response validation - contradict - false statemen

403

- Redhat have done testing on this and find, in their target workloads (think server,rather than desktop) that there is roughly a 1% to 5% loss of performance when PAE is used. AFAIK, their testing did not encompass the case in which the non-PAE server swapped, but the PAE one didn't, which would reverse the situation somewhat.

response giving - support own- direct link/verify

404

- The allegation that PAE turns physical RAM into virtual memory is bizarre. the virtual memory system turns physical memory into virtual memory and PAE adds a level of paging to that. So, as you note yourself, if you have a virtual memory system like Linux, then you have virtual memory and PAE doesn't change that (actually, even that's not totally true; non-virtual memory systems are used in some embedded applications, although that's not really relevant to this thread).

405

406 *Quote: An 80386 can handle 4 GB of physical RAM because the manual says so*

turn-taking - partial quote to contradict

407

408 P2 wrote:

409

410 *Quote: An x86 CPU manufacturer is free to say you can have a full 4GB of ram without PAE*

411

412 But, as far as I am aware, they don't. They are usually careful to say that you have a number of address lines or a certain address space and let people jump to the conclusion that they

response validation - contradict - false statemen

can use all of the address space for RAM, if they want to. Of course, even on archs on which the I/O is separately mapped, you wouldn't get the full amount for RAM, because you have to use some for a boot rom, and every hardware engineer would know that.

So, if you have a reference to an Intel manual saying "80386 can handle 4 GB of physical RAM" (and not 'up to' or 'physical address space for' or some other form of weasel words), I'd be interested.

response taking - request detail/explanation~

07-14-09, 08:09 AM
#17
P2
Senior Member

Registered: Dec 2007
Posts: 1,286
Thanked: 100

Quote: Originally Posted by P6
you wouldn't get the full amount for RAM, because you have to use some for a boot rom, and every hardware engineer would know that.

turn-taking - partial quote to ask confirm

Long ago, I worked on the hardware , bios and OS design of a hand held computer using a 486 cpu chip. That design mapped some of the ram at the same address as the boot rom. At system startup that section of ram was write only and the rom at the same address was, of course, read only. But after the bios code was done using the rom, the rom was turned off and the ram at the same address became ordinary read/write ram.

We didn't have GB's of ram, so there was no worry about whether there were holes in the 4GB address space. It just was a standard behavior of the available memory controller chip that the hole in the first MB could be turned on and off. Since our (non PC compatible) OS didn't use the rom nor any memory mapped I/O, we chose to switch shortly after boot to the mode where all of ram was contiguous without holes.

I don't think anyone now would make an x86 design that far from PC standards, but if you did so the boot rom isn't much of an issue.

response validation - correction - own mis-/poc

07-14-09, 08:30 AM
#18
P2
Senior Member

Registered: Dec 2007
Posts: 1,286
Thanked: 100

Quote: Originally Posted by P6

turn-taking - partial qoute to denounce

444 *Redhat have done testing on this and find, in their target workloads (think server, rather than desktop) that there is roughly a 1% to 5% loss of performance when PAE is used.*

445

446 Redhat often (maybe always, I'm not sure) ties PAE support together with the option to split the virtual address space 4GB/4GB instead of the usual 3GB/1GB. Are you sure the test you're quoting isn't a test of that feature?

response taking - request detail/explanation~

447

448 Either the overhead of just PAE or the overhead of the 4GB/4GB split varies enormously based on the workload you select. But they are on a very different scale. The 4GB/4GB split usually has far more overhead than PAE alone.

response validation - contradict - wrong assum

449

450 I think you would need a maliciously chosen very strange workload for the overhead of PAE to get anywhere near 5% (usually it should be well under 1%) while the overhead of the 4GB/4GB split ought to be in the 1% to 5% range for some common server workloads (but may go way over 5% for other possible server workloads).

451

452 I doubt RedHat intentionally chose a workload to make the feature look bad, so I think the 1% to 5% must be the overhead of the 4GB/4GB split, not the overhead of PAE alone.

453

454 I have read that somewhere around 8GB to 16GB of ram, the usual 3GB/1GB split tends to cause the system to run out of kernel virtual address space and you need either the 2GB/2GB split, which reduces user mode virtual memory or the 4GB/4GB split which has extra overhead. I have used a 32 bit PAE server with 8GB of ram and the 3GB/1GB split without any problems with kernel virtual address space. I don't know what differences in workload mix might make the 1GB limit on kernel virtual address space more or less of an issue.

455

456 *Last edited by P2; 07-14-09 at 08:38 AM..*

457 Thanked by:
458 P8

459

460 07-14-09, 08:46 PM
461 **#19**
462 P7
463 Guru

464

465 Registered: Jan 2002
466 Location: AZ
467 Distribution: Gentoo
468 Posts: 5,648
469 Thanked: 12

470

471 Quote: Originally Posted by **P6**
472 *So, if you have a reference to an Intel manual saying "80386 can handle 4 GB of physical RAM" (and not 'up to' or 'physical address space for' or some other form of weasel*

turn-taking - partial quote to contradict

Page: 17/17

words), I'd be interested.

473

474 I have the hard copy titled "80386 Programmer's Reference Manual by Intel." It states 4 KB pages have to be used in order to handle 4 GB of RAM. Go read it. PAE hides the truth.

response validation - contradict - false statemer

Appendix F. The Distribution of Essential Dialogic Actions in Three Forums

Action Domains	Action Performed					Content of Action					Argumentative Component				
	classes	total	A	B	C	classes	total	A	B	C	classes	total	A	B	C
To initiate inquiry	Expositives	2.6	2.9	2.8	1.9	Constructive	3.8	3.8	4.1	3.4	Backing	0.1	0.1	0.1	0.1
	Commisives	1.7	1.8	1.8	1.7	Unsupportive	0.5	0.6	0.5	0.2	Data	0.5	0.5	0.7	0.1
To maintain commitment	Declaratives	0.6	0.7	0.8	0.5	Supportive	3.1	3.9	3.2	1.3	Backing	0.1	0.1	0.3	
	Expositives	0.7	0.7	1.2	0.1	Unsupportive	0.9	1.1	0.8	0.7	General w	0.1	0.1	0.2	
	Commisives	2.5	2.9	3.0	1.4	Challenging	1.0	1.0	1.7	0.2	Personal w	0.0	0.0	0.1	
To guide process	Directives	2.4	3.0	2.4	1.5	Assimilating	1.8	2.5	1.9	0.5	Backing	0.2	0.2	0.3	0.0
	Dommisives	2.6	3.1	2.9	1.3	Challenging	2.7	2.7	3.2	2.1	Data	0.2	0.2	0.2	0.0
	Behavitives	16.9	19.5	11.5	18.8	Conversational	16.9	18.9	11.0	18.8	General w	0.1	0.3	0.1	0.0
To frame a problem	Declaratives	3.0	3.7	2.8	1.7	Constructive	6.3	6.7	6.7	5.3	Backing	0.3	0.5	0.3	0.1
	Dxpositives	4.8	4.7	5.6	4.3	Confused	4.4	4.7	3.1	5.2	Data	1.6	2.0	2.0	0.4
	Directives	4.2	4.4	3.0	5.2						Personal w	0.3	0.4	0.4	0.1
To negotiate solutions	Declaratives	3.7	5.3	2.6	1.7	Constructive	7.0	8.9	5.2	5.1	Backing	1.9	2.5	2.0	0.6
	Expositives	6.9	9.3	5.3	3.9	Supportive	2.1	2.7	2.2	0.9	Data	2.4	4.3	1.2	0.1
	Directives	7.7	8.7	6.8	6.5	Assimilating	0.9	1.2	0.8	0.4	Personal w	1.6	2.8	0.5	0.4
						Unsupportive	2.5	3.6	2.2	0.9	General w	2.2	3.2	1.6	1.0
						Declining	2.3	3.4	1.4	1.2					
						Challenging	2.6	3.1	2.1	2.1					
To confirm workability	Declaratives	27.0	16.0	10.0	1.0	Assimilating	1.4	1.4	1.7	0.9	Data	0.6	0.8	0.7	0.1
	Expositives	221.0	126.0	59.0	36.0	Declining	1.2	1.2	1.4	0.9					
	Directives	59.0	39.0	14.0	6.0	Challenging	0.9	1.2	0.8	0.3					

References

Ackerman, M. 2000. "The Intellectual Challenge of Cscw: The Gap between Social Requirements and Technical Feasibility," *Human-Computer Interaction* (15:2/3), pp 181-203.

Alavi, M., and Leidner, D.E. 2001. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), pp 107-136.

Alonzo, M., and Aiken, M. 2004. "Flaming in Electronic Communication," *Decision Support Systems* (36), pp 205-213.

Argyris, C. 1982. *Reasoning, Learning and Action. Individual and Organizational*. San Francisco, CA: Jossey-Bass.

Argyris, C., and Schön, D.A. 1978. *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addisson-Wesley.

Austin, J.L. 1962. *How to Do Things with Words: The William James Lectures Delivered at Harvard in 1955*. Oxford, UK: Oxford University Press.

Awazu, Y., and Desouza, K.C. 2004. "Open Knowledge Management: Lessons from the Open Source Revolution," *Journal of the American Society for Information Science and Technology* (55:11), Sep, pp 1016-1019.

Baba, Y., and Nobeoka, K. 1998. "Towards Knowledge-Based Product Development: The 3-D Cad Model of Knowledge Creation," *Research Policy* (26), pp 643-659.

Baker, A.C., Jensen, P.J., and Kolb, D.A. 2005. "Conversation as Experiential Learning," *Management Learning* (36:4), pp 411-427.

Baldwin, C. 2006. "Does Code Architecture Mitigate Free Riding in the Open Source Development Model," *Management Sciences* (52:7).

Barker, A., and Kolb, D. 1993. "Diversity, Learning, and Good Conversation," in: *Diversity and Differences in Organizations,* R. Sims and R. Dennehy (eds.). Westport, CN: Quorum Books.

Bench-Capon, T. 1998. "Specification and Implementation of Toumin Dialogue Game," *JURIX: The Eleventh Conference*, Nijmegen: Gerard Noodt Instituut, pp. 5-19.

Bergquist, M., and Ljungberg, J. 2001. "The Power of Gifts: Organizing Social Relationships in Open Source Communities," *Information Systems Journal* (11:4), pp 305-320.

Bessen, J. 2005. "Open Source Software: Free Provision of Complex Public Goods," Boston University, School of Law and Research on Innovation.

Blair, J.A., and Johnson, R.H. 1987. "Argumentation as Dialectical," *Argumentation* (1), pp 41-56.

Bock, G.W., Zmud, R.W., and Kim, Y.G. 2005. "Behavioral Intention Factors in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate," *MIS Quarterly* (29:1), pp 87-111.

Bohm, D. 1996. *On Dialogue*. New York, NY: Routledge.

Boland, R.J., and Tenkasi, R.V. 1995. "Perspective Making and Perspective Taking in Communities of Knowing," *Organization Science* (6:4), pp 350-372.

Boland, R.J.J., Tenkasi, R.V., and Te'eni, D. 1994. "Designing Information Technology to Support Distributed Cognition," *Organization Science* (5:3), pp 456-475.
Bouas, K.S., and Arrow, H. 1995. "The Development of Group Identity in Computer and Face-to-Face Groups with Membership Change," *Computer Supported Cooperative Work (CSCW)* (4:2-3), pp 153-178.
Boudreau, K., Lacetera, N., and Lakhani, K. 2011. "Incentives and Problem Uncertainty in Innovation Contests: An Empirical Analysis," *Management Science* (57:5), pp 843-863
Boudreau, K., and Lakhani, K. 2009. "How to Manage Outside Innovation," *MIT Sloan Management Review* (50:4), pp 69-76.
Bouty, I. 2000. "Interpersonal and Interaction Influences on Informal Resource Exchange between R&D Researcher across Organizational Boundaries," *Academy of Management Journal* (43:1), pp 50-66.
Boyatis, R. 1998. *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, CA: Sage.
Brézillon, P. 1999. "Context in Human-Machine Problem Solving: A Survey," *The Knowledge Engineering Review* (14), pp 1-34.
Brockriede, W., and Ehninger, D. 1960. "Toulmin on Argument: An Interpretation and Application," *Quarterly Journal of Speech* (46:1), pp 44-53.
Brown, A.W., and Booch, G. 2002. "Reusing Open-Source Software and Practices: The Impact of Open-Source on Commercial Vendors," in: *Software Reuse: Methods, Techniques, and Tools, Proceedings*. pp. 123-136.
Brown, G., and Yule, G. 1983. *Discourse Analysis*. Cambridge, MA: Cambridge University Press.
Brown, J.S., and Duguid, P. 1991. "Organizational Learning and Communities of Practice: Toward a Unified View of Working, Learning, and Innovation," *Organization Science* (2:1), pp 40-57.
Brown, J.S., and Duguid, P. 2000. *The Social Life of Information*. Boston, MA: Harvard Business School Press.
Brown, J.S., and Duguid, P. 2002. *The Social Life of Informatioin*. Harvard Business School Publishing.
Brown, P., Levinson, S.C., and Gumperz, J.J. 1987. *Politeness: Some Universals in Language Usage*. Cambridge, MA: Cambridge University Press.
Brown, S.I., and Walter, M.I. 2005. *The Art of Problem Posing*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
Buchanan, R. 1992. "Wicked Problems in Design Thinking," *Design Issues* (8:2), pp 5-21.
Butler, B. 2001. "Membership Size, Communication Activity, and Sustainability: A Resource-Based Model of Online Social Structures," *Information Systems Research* (12:4), pp 346-362.
Chesbrough, H., Vanhaverbeke, W., and West, J. 2006. *Open Innovation: A New Paradigm for Understanding Industrial Innovation*. Oxford University Press.
Clark, H. 1996. *Using Language*. Cambridge, UK: Cambridge University Press.
Cohen, L.J. 1964. "Do Illocutionary Forces Exist? ," *The Philosophical Quarterly* (14:55), pp 118-137.
Conklin, J. 1989. "Design Rationale and Maintainability," *Software Track, Proceedings of the Twenty-Second Annual Hawaii International Conference on System Sciences*.

Conklin, J., and Yakemovic, K.C.B. 1991. "A Process-Oriented Approach to Design Rationale," *Human-Computer Interaction* (6:3).
Constant, D., Sproull, L., and Kiesler, S. 1996. "The Kindness of Strangers: The Usefulness of Electronic Weak Ties for Technical Advice," *Organization Science* (7:2), pp 119-135.
Corbin, J.M., and Strauss, A. 1990. "Grounded Theory Research: Procedures, Canons, and Evaluative Criteria " *Qualitative Sociology* (13:1), pp 3-21.
Cramton, C.D. 2001. "The Mutual Knoweldge Problem and Its Consequences for Dispersed Collaboration," *Organization Science* (12:3), pp 346-371.
Cummings, A., Schlosser, A., and Arrow, H. 1995. "Developing Complex Group Products: Idea Combination in Computer-Mediated and Face-to-Face Groups," *Computer Supported Cooperative Work (CSCW)* (4:2-3), pp 229-251.
Dahlander, L., Frederiksen, L., and Rullani, F. 2008. "Online Communities and Open Innovation: Governance and Symbolic Value Creation," *Industry and Innovation* (15:2), pp 115-123.
DeSanctis, G., Fayard, A.-L., Roach, M., and Jiang, L. 2003. "Learning in Online Forums," *European Management Journal* (21:5), pp 565-577.
Dewey, J. 1938. *Logic: The Theory of Inquiry*. New York, NY: Henry Holt & Co.
Dillon, J.T. 1990. *The Practice of Questioning*. London and New York: Routledge
Eisenhardt, K.M. 1989. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), October, pp 532-550.
Fairclough, N. 1992a. *Discourse and Social Change*. Cambridge, UK: Polity Press.
Fairclough, N. 1992b. "Discourse and Text: Linguistic and Intertextual Analysis within Discourse Analysis," *Discourse & Society* (3:2), pp 193-217.
Fairclough, N. 2001. "The Discourse of New Labour: Critical Discourse Analysis," in: *Discourse as Data: A Guide for Analysis* S.T. Simeon Yates, Margaret Wetherell (ed.). London, UK: Sage Publications.
Fairclough, N. 2003. *Analysing Discourse: Textual Analysis for Social Research*. New York, NY: Routledge.
Faldetta, G. 2002. "The Content of Freedom in Resources: The Open Source Model," *Journal of Business Ethics* (39:1-2), Aug, pp 179-188.
Faraj, S., Jarvenpaa, S., and Majchrzak, A. 2011. "Knowledge Collaboration in Online Communities," *Organization science* (22:5), pp 1224-1239.
Fayard, A.-L., and DeSanctis, G. 2008. "Kiosks, Clubs and Neighborhoods: The Language Games of Online Forums," *Journal of the Association for Information Systems* (9:10), pp 677-705.
Felder, R.M., and Silverman, L.K. 1988. "Learning and Teaching Styles in Engineering Education," *Engineering Education* (78:7), pp 674-681.
Fleming, L., and Waguespack, D. 2007. "Brokerage, Boundary Spanning, and Leadership in Open Innovation Communities," *Organization science* (18:2), pp 165-180.
Fredberg, T., Elmquist, M., and Ollila, S. 2008. "Managing Open Innovation - Present Findings and Future Directions," VINNOVA - Verket för Innovationssystem/Swedish Governmental Agency for Innovation Systems.
Garton, L., Haythornthwaite, C., and Wellman, B. 1997. "Studying Online Social Networks," *Journal of Computer-Mediated Communication [Online]* (3:1).

Glaser, B., and Strauss, A. 1967. *The Discovery of Grounded Theory: Strategies for Quantittive Research*. Chicago, IL: Aldine publishing company.

Gloor, P.A. 2006. *Swarm Creativity : Competitive Advantage through Collaborative Innovation Networks* Oxford ; New York: Oxford University Press.

Gohosh, R.R., Robles, G., and Glott, R. 2002. "Free/Libre and Open Source Software: Survey and Study Part V," International Institute of Infonomics, University of Maastricht, The Netherlands.

Gongla, P., and Rizzuto, C.R. 2001. "Evolving Communities of Practice: Ibm Global Services Experience," *IBM Systems journal* (40:4), pp 842-862.

Goodman, P.S., and Darr, E.D. 1998. "Computer-Aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments," *MIS Quarterly*), pp 417-440.

Goodwin, C., and Heritage, J. 1990. "Conversation Analysis," *Annual Review of Anthropology* (19), pp 283-307.

Grandori, A., and Soda, G. 1995. "Inter-Firm Networks: Antecedents, Mechanism, and Forms," *Orgnization Studies* (16:2), pp 183-214.

Grant, R. 1996a. "Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration," *Organization science* (7:4), pp 375-387.

Grant, R.M. 1996b. "Toward a Knowledge-Based Theory of the Firm," *Strategic Management journal* (17), pp 109-122.

Gregor, S., and Jones, D. 2007. "The Anatomy of a Design Theory " *Journal of Association for Information Systems* (8:2), pp 312-335.

Gruber, S., Peyton, J.K., and Bruce, B.C. 1994. "Collaborative Writing in Multiple Discourse Contexts," *Computer Supported Cooperative Work (CSCW)* (3:3-4), pp 247-269.

Gruber, T.R. 1993. "A Translation Approach to Portable Ontology Specifications," *Knowledge Acquisition* (5:2), pp 199-220.

Gu, B., and Jarvenpaa, S. 2003. "Online Discussion Boards for Technical Support: The Effect of Token Recognition on Customer Contributions," *24th International Conference on Information Systems*, Atlanta, GA: Association for Information Systems.

Habermas, J. 1990. *Moral Consciousness and Communicative Action*. Cambridge: MIT Press.

Hansen, M.T. 1999. "The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits," *Administrative Science Quarterly* (44:1), pp 82-111.

Harris, Z.S. 1952. "Discourse Analysis," *Language* (28:1), pp 1-30

Hemetsberger, A., and Reinhardt, C. 2006. "Learning and Knowledge-Building in Open-Source Communities a Social-Experiential Approach," *Management Learning* (37:2), pp 187-214.

Herring, S.C. 2001. "Computer-Mediated Discourse," in: *Handbook of Discourse Analysis,* D. Tannen, D. Schiffrin and H. Hamilton (eds.). Oxford, MA: Blackwell.

Hiltz, S., Turoff, M., and johnson, K. 1989. "Experiments in Group Decision Making: 3. Disinhibition, Deindividuation, and Group Process in Pen Name and Real Name Computer Conferences," *Decision Support Systems* (5:2), pp 217-232.

Huber, G.P. 2001. "Transfer of Knowledge in Knowledge Management Systems: Unexplored Issues and Suggested Studies," *European Journal of Information Systems* (10), pp 72-79.

Hutchby, I., and Wooffitt, R. 1998. *Conversation Analysis : Principles, Practices, and Applications*. Malden, MA: Polity Press.

Hutchins, E. 1995. *Cognition in the Wild*. Cambridge, MA: MIT Press.

Hutter, K., Hautz, J., Füller, J., Mueller, J., and Matzler, K. 2001. "Communitition: The Tension between Competition and Collaboration in Community-Based Design Contests," *CREATIVITY AND INNOVATION MANAGEMENT* (20:1).

Isaacs, E.A., and Clark, H.H. 1987. "References in Conversation between Experts and Novices," *Journal of Experimental Psychology* (116:1), pp 26-37.

Jackson, S., and Jacobs, S. 1980. "Structure of Conversational Argument: Pragmatic Bases for the Enthymeme " *Quarterly Journal of Speech* (66:3), pp 251-265.

Jones, Q., G., Ravid, G., and Rafaeli, S. 2004. "Information Overload and the Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration," *Information Systems Research* (15:2), pp 194-210.

Jung, Y., and Boland, R.J. 2009. "How You Question Is What You Get: A Collective Inquiry Dialogues in Online Forums," *Proceedings of 15th Americas Conference on Information Systems* San Francisco: AMCIS.

Kankanhalli, A., Tan, B.Y., and Wei, K. 2005. "Continue Knowledge to Electronic Knowledge Repositories: An Commercial Investigation," *MIS Quarterly* (29:1), March, pp 113-143.

Kereki, I.F., Azpiazu, J., and Silva, A. 2004. "Knowledge Management in Learning Environment Design," *34th ASEE/IEEE Frontiers in Education Conference*, Savannah, GA: IEEE.

Ko, D.G., Kirsch, L.J., and King, W.R. 2005. "Antecedents of Knowledge Transfer from Competent to Clients in Enterprise System Implementations," *MIS Quarterly* (29:1), March, pp 59-85.

Kogut, B. 2000. "The Network as Knowledge: Generative Rules and the Emergence of Structure," *Strategic Management journal* (21), pp 405-425.

Kogut, B., and Metiu, A. 2001. "Open Source Software Development and Distributed Innovation," *Oxford Review of Economic Policy* (17:2), pp 248-264.

Kolb, A.Y., and Kolb, D.A. 2005. "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education," *Academy of Management Learning & Education* (4:2), pp 193-212.

Kolb, D.A. 1984. *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice-Hall.

Kolb, D.A., Baker, A.C., and Jensen, P.J. 2002. "Conversation as Experiential Learning," in: *Conversational Learning: An Experiential Approach to Knowledge Creation,* A.C. Baker, P.J. Jensen and D.A. Kolb (eds.). Wesrport: Quorum Books.

Kolb, D.A., Boyatzis, R.E., and Mainemelis, C. 2001. "Experiential Learning Theory: Previous Research and New Directions," *Perspectives on Thinking, Learning, and Cognitive Styles*), pp 227-247.

Kolbe, R.H., and Burnett, M.S. 1991. "Content-Analysis Research: An Examination of Applications with Directives for Improving Research Reliability and Objectivity," *Journal of Consumer Research Policy* (18), pp 243-250.

Kozinets, R. 2002. "The Field Behind the Screen: Using Netnography for Marketing Research in Online Communities," *Journal of Marketing Research* (39:February), pp 61-72.
Kudaravalli, S., and Faraj, S. 2008. "The Structure of Collaboration in Electronic Networks," *Journal of the Association for Information Systems* (9:10).
Lacity, M.C., and Janson, M.A. 1994. "Understanding Qualitative Data: A Framework of Text Analysis Methods," *Journal of Management Information Systems* (11:2), pp 137-155.
Lakhani, K.R., and Von Hippel, E. 2003. "How Open Source Software Works: "Free" User-to-User Assistance," *Research Policy*:32), pp 923–943.
Latour, B. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.
Lave, J. 1993. "Situated Learning in Communities of Practice," in: *Perspectives on Socially Shared Cognition,* L.B. Resnick, J.M. Levine and S.D. Teasley (eds.). Washington, D.C.: American Psychological Association, pp. 63-82.
Lave, J., and Wenger, E. 1991a. *Situated Learning*. Cambridge, UK: Cambridge University Press.
Lave, J., and Wenger, E. 1991b. *Situated Learning: Legitimate Peripheral Participation*. Cambridge, MA: Cambridge University Press.
Lebie, L., Rhoades, J.A., and Mcgrath, J.E. 1995. "Interaction Process in Computer-Mediated and Face-to-Face Groups," *Computer Supported Cooperative Work (CSCW)* (4:2-3), pp 127-152.
Lee, G.K., and Cole, R.E. 2003. "From a Firm-Based to a Community-Based Model of Knowledge Creation: The Case of the Linux Kernel Development," *Organization Science* (14:6), Nov-Dec, pp 633-649.
Lee, T.B., Hendler, J., and Lassila, O. 2001. "The Semantic Web, a New Form of Web Content That Is Meaningful to Computers Will Unleash a Revolution of New Possibilities." Scientific America.
Liakopoulos, M. (ed.) 2000. *Argumentation Analysis*. London, UK: Sage Publications.
Liddicoat, A. 2007. *An Introduction to Conversation Analysis*. New York, NY: Continuum.
Lombard, M., Snyder-Duch, J., and Bracken, C. 2002. "Content Analysis in Mass Communication: Assessment and Reporting of Intercoder Reliability," *Human Communication Research* (28:4), pp 587-604.
Majchrzak, A., Malhortra, A., and John, R. 2005. "Perceived Individual Collaboration Know-How Development through Information Technology-Enabled Contextualization: Evidence from Distributed Teams," *Information Systems Research* (12:1), pp 9-27.
Mann, W., and Thompson, S. 1987. "Rhetorical Structure Theory: A Framework for the Analysis of Texts ").
Markus, M.L. 2001. "Toward a Theory of Knoweldge Reuse: Types of Knoweldge Reuse Situations and Factors in Reuse Success," *Journal of Management Information Systems* (18:1), Summer, pp 57-93.
Markus, M.L., Manville, B., and Agres, C.E. 2000. "What Makes a Virtual Organization Work?," *Sloan Management Review* (42), pp 13-26.

Martin, P.Y., and Turner, B.A. 1986. "Grounded Theory and Organizational Research," *The Journal of Applied Behavioral Science* (22:2), pp 141-157.
McCarthy, M. 2008. "Discourse Analysis," *ELT Journal* (62:2), pp 211-213.
Mockus, A., Fielding, R., and Herbsleb, J.D. 2002. "Two Case Studies of Open Source Software Development: Apache and Mozilla," *ACM Transactions on Software Engineering and Methodology* (11:3), July, pp 309-346.
Nelson, K.M., and Cooperider, J.G. 1996. "The Contribution of Shared Knowledge to Is Group Performance," *MIS Quarterly* (20:4), December, pp 409-432.
Neuendorf, K.A. 2002. *The Content Analysis Guidebook*. Sage.
Newell, A., and Simon, H.A. 1972. *Human Problem Solving*. Englewood, NJ: Prentice-Hall, Inc.
Nidumolu, S.R., Subramani, M., and Aldrich, A. 2001. "Situated Learning and the Situated Knowledge Web," *Journal of Management Information Systems* (18:1), pp 115-150.
Nonaka, I., and Konno, N. 1998. "The Concept of "Ba": Building a Foundation for Knowledge Creation," *California Management Review* (40:3), pp 40-55.
O'Reilly, T. 1999. "Lessons from Open Source Software Development," *Communications of the ACM* (42:4), pp 33-37.
Orlikowski, W.J. 2002. "Knowing in Practice: Enacting a Collective Capability in Distributed Organizing," *Organization Science* (13:3), May-June, pp 249-273.
Orlikowski, W.J., and Yates, J. 1994. "Genre Repetoire: The Structuring of Communicative Practices in Organizations," *Administrative Science Quarterly* (39), pp 541-574.
Orr, J. 1990. "Sharing Knowledge, Celebrating Identity: War Stories and Community Memory in a Service Culture," in: *Collective Remembering: Memory in Society,* D.S. Middleton and D. Edwards (eds.). Beverly Hills, CA: Sage Publications.
Palen, L., Hiltz, S.R., and Liu, S.B. 2007. "Online Forums Supporting Grassroots Participation in Emergency Preparedness and Response," *Communication od the ACM* (50:3), pp 54-58.
Pentland, B.T. 1992. "Organizing Moves in Software Support Hot Lines," *Administrative Science Quarterly* (37:4), pp 527-548.
Pentland, B.T., and Rueter, H.H. 1994. "Organizational Routines as Grammars of Action," *Administrative Science Quarterly* (39:3), pp 484-510.
Raymond, E. 1999. "The Cathedral and the Bazaar: Musings on Linux an Open Source by an Accidental Revolutionary," *First Monday*).
Reed, C. 2006. "Representing Dialogic Argumentation " *Knowledge-Based Systems* (19:1), pp 22-31.
Ridings, C., and Wasko, M. 2010. "Online Discussion Group Sustainability: Investigating the Interplay between Structural Dynamics and Social Dynamics over Time," *Journal of Association for Information Systems* (12:2).
Rittel, H.W.J., and Webber, M.M. 1973. "Dilemmas in a General Theory of Planning," *Policy Sciences* (4), pp 155-169.
Sacks, H., and Jefferson, G. 1992. *Lectures on Conversation*. Oxford, Blackwell
Sacks, H., Schegloff, E.A., and Jefferson, G. 1974. "A Simplest Systematics for the Organization of Turn-Taking for Conversation " *Language* (50:4), pp 696-735.
Salmon, M. 1995. "Analyzing Conversational Reasoning," *Informal logic* (17:1), pp 1-23.

Sawhney, M., Verona, G., and Prandelli, E. 2005. "Collaborating to Create: The Internet as a Platform for Customer Engagement in Product Innovation," *Journal of Interactive Marketing* (19:4), pp 4-17.
Schegloff, E. 2007. *Sequence Organization in Interaction : A Primer in Conversation Analysis*. Cambridge ; New York: Cambridge University Press.
Searle, J. 1975. "Indirect Speech Acts, V. 3, 1975, P. 59.," *Syntax And Semantics* (3), pp 59-82.
Searle, J. 1989. "How Performatives Work," *Linguistic and Philosophy* (12), pp 535-558.
Searle, J.R. 1968. "Austin on Locutionary and Illocutionary Acts," *The Philosophical Review* (77:4), pp 405-424.
Searle, J.R. 1969. *Speech Acts: An Essay in the Philosophy of Language*. London: Cambridge U.P.
Searle, J.R. 1976. "A Classification of Illocutionary Acts " *Language in Society* (5:1), pp 1-23.
Sherry, L. 2000. "The Nature and Purpose of Online Conversations: A Brief Synthesis of Current Research," *International Journal of Educational Telecommunications* (6:1), pp 19-52.
Silverman , D. 2001. *Interpreting Qualitative Data : Methods for Analysing Talk, Text and Interaction*. London: Sage.
Singh, J., and Jayanti, R.K. 2008. "Learning Together: An Inquiry-Action Framework for Longitudinal Analysis of
Online Peer-to-Peer Consumer Communities." Case Western Reserve University.
Sproull, L., and Keisler, S. 1991. *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.
Stalpers, J. 1988. "Review: The Maturity of Discourse Analysis " *Language in Society* (17:1), pp 87-97
Stasser, G., Vaughan, S., and Stewart, D.D. 2000. "Pooling Unshared Information: The Benefits of Knowing How Access to Information Is Distributed among Group Members," *Organizational Behavior and Human Decision Processes* (82:1), May, pp 102-116.
Stewart, K.J., and Gosain, S. 2006. "The Impact of Ideology on Effectiveness in Open Source Software Development Teams," *MIS Quarterly* (30:2), pp 291-314.
Strawson, P.F. 1964. "Intention and Convention in Speech Acts " *The Philosophical Review* (73:4), pp 439-460.
Szulanski, G. 2000. "The Process of Knowledge Transfer: A Diachronic Analysis of Stickiness," *Organizational Behavior and Human Decision Processes* (829-27:1).
Thorn, B.K., and Connolly, T. 1987. "Discretionary Data Bases: A Theory and Some Experimental Findings," *Communication Research* (14), pp 512-528.
Toulmin, S.E. 1958. *The Uses of Argument*. Cambridge, UK: The Cambridge University Press.
Trauth, E.M., and Jessup, L.M. 2000. "Understanding Computer-Mediated Discussions: Positivist and Interpretive Analyses of Group Support System Use," *MIS Quarterly* (24:1), pp 43-79.
Urquhart, C., Lehmann, H., and Myers, M.D. 2009. "Putting the 'Theory' Back into Grounded Theory: Guidelines for Grounded Theory Studies in Information Systems," *Information Systems Journal* (20), pp 357-381.

Van de Van, A. 2007. *Engaged Scholarship: A Guide for Organizational and Social Research*. Oxford University Press.
van Dijk, T. 1993. "Principles of Critical Discourse Analysis," *Discourse & Society* (4:2), pp 249-283.
van Dijk, T. 2003. "Critical Discourse Analysis," in: *The Handbook of Discourse Analysis,* D. Tannen, D. Schiffrin and H. Hamilton (eds.). Blackwell Publishing.
Von Hippel, E., and Von Krogh, G. 2003. "Open Source Software and the "Private-Collective" Innovation Model: Issues for Organization Science," *Organization Science* (14:2), Mar-Apr, pp 209-223.
Von Krogh, G., Spaeth, S., and Lakhani, K.R. 2003. "Community, Joining, and Specialization in Open Source Software Innovation: A Case Study," *Research Policy* (32:7), Jul, pp 1217-1241.
Wasko, M.M., and Faraj, S. 2005. "Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice," *MIS Quarterly* (29:1), March, pp 35-57.
Weick, K.E. 1979. *The Social Psychology of Organizing*. New York, NY: Random House.
Weick, K.E. 1993. "The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster," *Administrative Science Quarterly* (38:4), pp 628-652.
Weick, K.E., and Roberts, K.H. 1993. "Collective Mind in Organizations: Heedful Interrelating on Flight Decks," *Administrative Science Quarterly* (38), pp 357-381.
Wenger, E. 1998. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge, UK: Cambridge University Press.
Wenger, E.C., and Snyder, W.M. 2000. "Communities of Practice: The Organizational Frontier," *Harvard Business Review*), January-February.
West, J., and Gallagher, S. 2006. "Challenges of Open Innovation: The Paradox of Firm Investment in Open-Source Software," *R&D Management* (36:3), pp 319-331.
Widdowson, H.G. 2007. *Discourse Analysis*. Oxford University Press 2007.
Yin, R.K. 2003. *Case Study Research: Design and Methods*. Thousand Oaks, CA: SAGE Publications, Inc.
Zhang, J., Ackerman, M.S., and Adamic, L. 2007. "Expertise Networks in Online Communities: Structure and Algorithms," *Proceeding WWW '07 Proceedings of the 16th international conference on World Wide Web*